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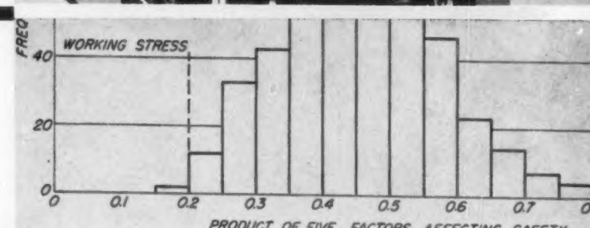

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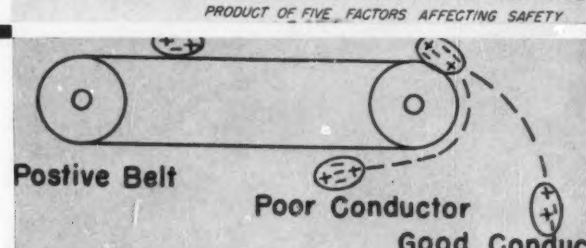

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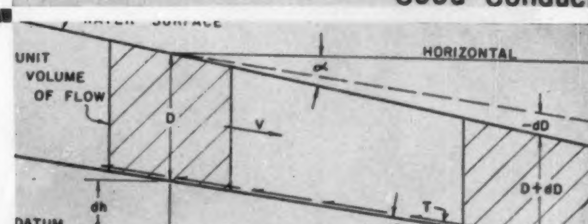

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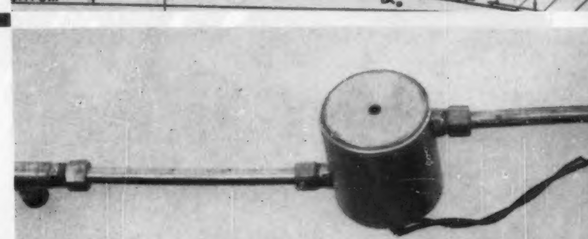

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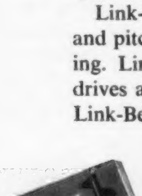

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# Agricultural Engineering

*Established 1920*

**CONTENTS** · **JANUARY, 1961** · **Vol. 42, No. 1**



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JAMES BASSELMAN, *Editor and Publisher*



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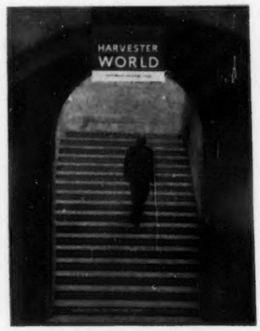
## Archie Stone Honored . . .

A FINE tribute to Archie A. Stone, Life Member of ASAE, appeared in the September-October issue of *Harvester World,* house organ of International Harvester Co. The story entitled "Archie Stone: He looks for Trends" not only filled seven pages (the first seven in the issue and liberally illustrated), but was featured also on the front cover. A reproduction of the entire cover is shown.




It seems that the nature of Archie's work, that of special representative of the company's executive staff with headquarters in Washington, D. C., has earned for him this special recognition. It all started 12 years ago, according to the report, when Archie began a unique mission to find out "what the other guy's thinking" as directed by former IH chairman J. L. McCaffrey. Archie's assignment is described as a "listening post" and in his travels he "patrols the capitol, colleges, research centers, and farms."

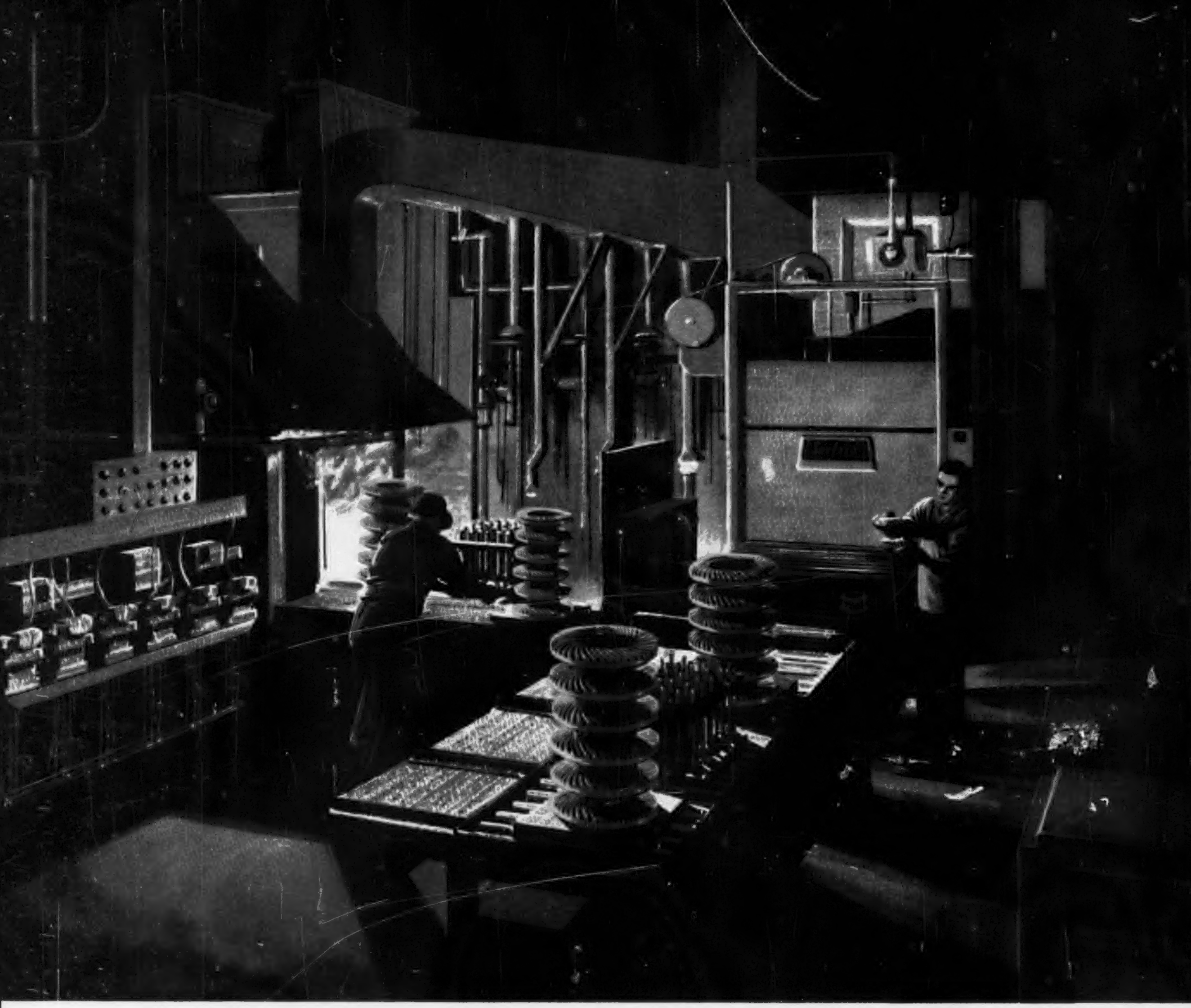
The excellent selection of illustrations portrays several of his "pulse-feeling" checking stations in his wide range of operations. Archie is shown in the shadow of the Capitol, in a water problem discussion with Senator Robert S. Kerr (Okla.), in a weather modification discussion with Senator Francis Case (S. D.), and in a rural development conference with Under Secretary of Agriculture True D. Morse and staff. In other cases he is shown examining film made from high amylose corn at USDA's Utilization Research and Development Division, and observing electrical measurement of fat on hogs and discussing windrower-crusher performance with Dr. E. G. McKibben at USDA, Beltsville, Md., Agricultural Research Center. Also in Beltsville, he is shown checking operating adjustments on an experimental fertilizer-seeder drill, observing bulk milk cooler procedure, and inspecting an electronic analyzer for measuring radioactive fallout.

During a visit to the University of Maryland, he was photographed as he conferred with the University's dean of agriculture, Dr. G. M. Cairns. Pictures taken during a visit to the agricultural engineering department at the University of Maryland show Archie, R. L. Green (department head) and staff members observing a cutaway combine classroom aid, an aluminum auger being machined for seed handling equipment, and a high-speed camera which freezes motion at the rate of 8,500 frames a second.

In his grass-roots contacts, Archie is shown visiting a hay field during the hay baling season, and in one view is completely surrounded by a herd of Holsteins.

We, too, honor Archie A. Stone — an agricultural engineer whose drafting board is an entire nation, and whose slide rule feeds on facts relating to trends, research developments and events which influence company policy.

*54th Annual Meeting of ASAE*
*Iowa State University, Ames*
*June 25-28*



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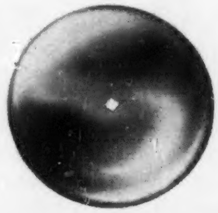

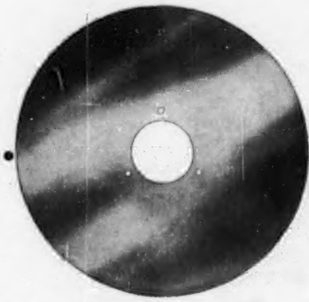

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# Report to Readers . . .

**GRAPHITE-COATED SEED CORN SPEEDS PLANTING** A graphite manufacturer announces a new, practical use for graphite in the foliated form. Its lubricating action, when used in corn planters or drills, results in more uniform planting of the seed. This proves especially helpful in the case of seed corn that has become sticky from treatment with insecticides. The graphite-lubricated seeds will not adhere to each other or to the planter, thereby resulting in more uniform feeding of the seed. . . . . It is claimed that the dark color produced by the graphite offers the additional advantage of faster germination – also less waste since crows are not attracted by the coated seed.

**MECHANICAL ROTARY WEEDER FOR CONTROLLING WEEDS IN PEANUTS** Manual hoe chopping to control weeds calls for about 30 percent of the total man-hours needed to raise an acre of peanuts in the Virginia-North Carolina peanut belt. To reduce this requirement, agricultural engineers at Virginia PI report they are developing an experimental machine consisting of a one-row, power-take-off-driven rotary weeder mounted on a three-point-hitch cultivator frame and connected to the hydraulic system of the tractor that powers it. . . . . The machine controls weeds by pulverizing the soil surface and depends, for its action, on the differential resistance between small, shallow-rooted weeds and the deep-rooted, straight-stemmed peanut plants. . . . . An economic analysis of the results of the experiment thus far indicates that the rotary weeder has promising possibilities for controlling weeds. The study further reveals that use of such a machine would increase the net return by almost $7 per acre over the conventional method of hoe chopping – and also do away with the per acre requirement of 20 hours of manual hoe chopping.

**AGRONOMIC FACTORS AFFECTING THE DESIGN OF GRAIN DRILLS** Of particular interest to designers and manufacturers of grain drills is a study made by a USDA-Michigan AES research group and reported at an ASAE meeting last month. The research dealt with germination and emergence problems resulting from the growing practice of using higher grades and application rates of fertilizer, in contact with the seed, in the conventional grain drill. . . . . Various methods of reducing the toxic effect of fertilizer salts were investigated, the results of which indicate that fertilizer should be banded close to but definitely separate from the seed. Highest yields were obtained when fertilizer was placed in a band one inch to the side of the seed and one or two inches below seed level. . . . . In the investigation of row spacings, in relation to fertilizer placement and crop yield, there was found to be little or no difference from 7, 9 and 11-inch row spacings in the yield range up to 60 bushels of wheat per acre. In the range of 100 bushels or less, oats yielded equally as well in the 7, 9, and 11-inch spacings. In the range of 100 bushels or more, however, oat yields were reduced when row spacings were increased to more than 7 inches.

**AMOUNT OF SOIL COMPACTION INDICATED BY VEHICLE RUTS** California AES agricultural engineers report that X rays of agricultural soils in a large container will show what takes place when a rut is made in the soil surface by a load such as that produced by the track of a track-type tractor. In tests with unsaturated soils, 70 to 100 percent of the rut volume was found to be absorbed in the soil by reducing the amount of pore space between the soil particles, thereby causing the soil to become more dense. . . . . If the rut is shallow in comparison to its width, it indicates that most of the reduction of pore space is close to the surface – also that most of the energy required to produce the rut is used to compact the soil. . . . . If the rut is narrow compared to its depth, the pore space is affected at greater depths in the soil, and much of the energy used in making the rut is absorbed in shearing the soil. With some soils, the engineers point out, this shearing effect may result in a large reduction of the soil's resistance to compaction.

*(Continued on page 8)*

## . . . Report to Readers *(Continued from page 6)*

AIR JETS HOLD PROMISE FOR FRUIT HARVESTING

A Michigan AES agricultural engineering-horticultural research team have effected what may well prove a significant breakthrough in developing a mechanical harvester for tree fruit. It is completely mechanical and operates by shaking the fruit from the tree with a blast of air. This same air blast is also made to serve as a cushion for "floating" the fruit down gently to a perforated rubber conveyor belt that carries it along to storage boxes. . . . . The air blast is produced by two 36-inch fans set at the bottom of a 3 x 6-foot duct that is about 8 feet high. The conveyor belt runs across the bottom of the duct above the fans. . . . . Laboratory tests show that apples can be floated by jets of air, but the chief problem confronting the researchers appears to be that of developing sufficient air power to do the job. This development is still very much in the experimental stage.

EFFECT OF CORN TOPPING ON THE MATURITY RATE

A former Iowa AES agricultural engineer told an ASAE meeting last month that his research findings show that cutting off the tassel and top four or five leaves of the corn plant will seldom hasten the rate of field drying. This conclusion is based on findings of a two-year study at the Iowa station, and other experiment stations have reported similar results. . . . . In fact, the Iowa report states that topping corn generally results in reduced yields, a reduction by as much as 11 bushels per acre having been noted in one case of corn topped 10 days following pollination.

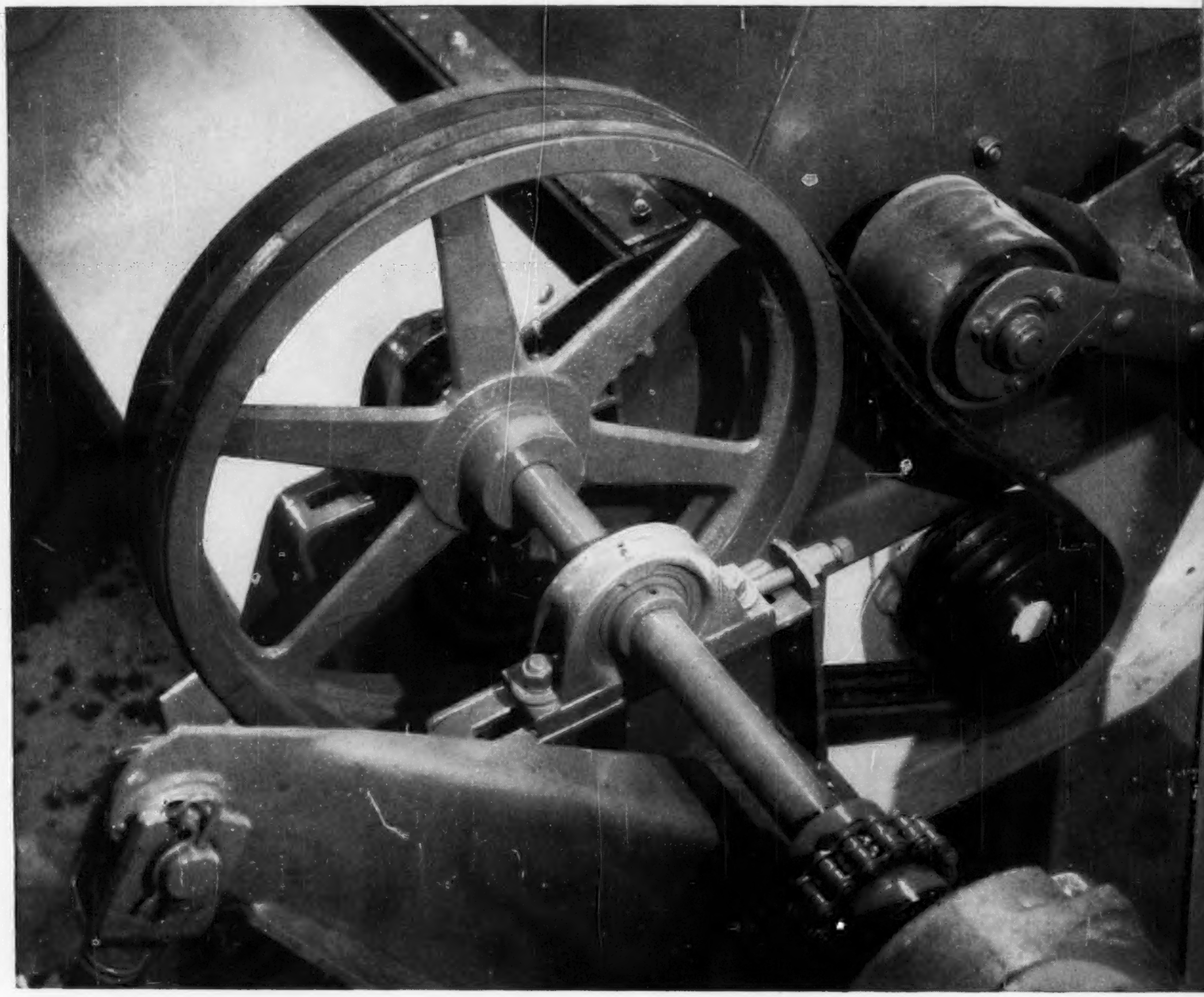
ENGINEERS DEVELOP EQUIPMENT FOR NEW SYSTEM OF STRAWBERRY CULTURE

Cornell pomologists having hit upon a new system of strawberry culture capable of producing yields two to three times the state (New York) average, called on the agricultural engineers for help with one of the key production problems. . . . . The new system provided for spacing the mother plants about one foot apart and removing all runners. To offset the prohibitive cost of hand labor to remove runners with minimum damage to mother plants, the engineers have had on trial two promising machines for this purpose. . . . . One of these machines employs a delicate rake which operates across several rows of plants, thereby removing the runners from each row and positioning them in the paths of the cutting devices. Yield results show that sharp, deeply serrated, ground-driven coulters will do a satisfactory job of cutting the runners. . . . . The engineers are extending their investigation in this area to cultivation and weed control in established plantings, where a straw mulch is employed, and machines are being studied and modified to meet this need in the strawberry cultural system.

CORNCOBS AS BACKFILL MATERIAL FOR TILE DRAIN BLIND INLETS

An Iowa State University agricultural engineer reported to an ASAE meeting that his research studies have shown that, when used as backfill material in blind inlets to tile drains, corncobs will remove water from Iowa potholes faster than any other material tested. Besides the corncobs, sand, a gradated material, and a soil backfill are included in the tests now under way. Trends detected from the tests thus far indicate that (a) use of corncobs and gradated backfill material result in higher discharge rates than sand or soil, (b) sand consistently gives the lowest discharge rate, (c) each material shows no consistent year-to-year change in discharge rate, though individual inlets may vary, and (d) corncobs showed the greatest variation in discharge while sand showed the lowest. . . . . Another phase of the Iowa experiments will be to determine whether water flows down through all the spaces in each of the backfill materials, that is, whether all voids are filled with water or whether some are filled with air. A particular question for which an answer will be sought in this study is: What will be the effect on flow rates through the corncob inlets as the material is decomposed?





# "Four Dayton Die-Cut V-Belts Out Perform 6 Standard Belts"

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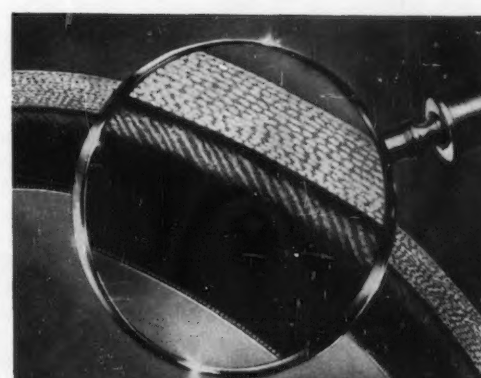

# Agricultural Engineering

January 1961
Number 1
Volume 42

James Basselman, *Editor*


## International Commission of Agricultural Engineering

DURING the ASAE Winter Meeting, held in Memphis in December, the Council of ASAE voted to apply for membership in the International Commission of Agricultural Engineering (Commission International du Genie Rural "CIGR"), pending ratification by the ASAE membership by letter ballot. In order that members of ASAE might be informed of the scope and purpose of the international organization, the following recommendation has been made by L. H. Skromme, past-president of ASAE:

The Commission Internationale du Genie Rural (CIGR) was set up by a Constituent Assembly held at Liege, Belgium, in August 1930. It is the only international association of agricultural engineering groups and is composed of national associations as well as individual members from countries which have not yet formed a national society.

Following is a listing of countries which are presently represented in CIGR membership. Those countries which have national associations of agricultural engineers affiliated with CIGR are indicated with an asterisk, while the other countries listed have only individual member affiliations.

1. Argentina
2. *Belgium
3. *England
4. Finland
5. *France
6. *Germany
7. Greece
8. *Holland
9. *Italy
10. Luxemburg
11. Morocco
12. *Portugal
13. *Spain
14. Sweden
15. *Switzerland
16. Turkey
17. Yugoslavia

The French association has approximately 300 members and the next largest group is in Germany, which is known as KTL (Kuratorium fur Tecknik in der Landwirtschaft).

Although the matter had been considered a number of times, ASAE had never become affiliated with CIGR. One of the functions of CIGR is to sponsor an International Congress on agricultural engineering about every five years, and ASAE members have participated in a number of these sessions and have sent delegates to these meetings as follows:

At the First Congress in 1930, ASAE was recognized as a donating member with H. B. Josephson as its official delegate. In 1935 the United States agricultural attache then stationed in Paris served as the ASAE official delegate at the Second Congress held in Madrid. G. W. McCuen (then president of ASAE) and J. B. Davidson also attended. ASAE has no records of the Third Congress and apparently there was no participation from United States in the Fourth Congress held in Rome in 1951. More than 400 agricultural engineers representing most of Western European Nations including delegates from North and South America, Africa and Asia participated in the Fifth Congress held in Brussels, Belgium, in 1958. Twelve agricultural engineers headed by then ASAE President E. G. McKibben, Vice-President L. W. Hurlbut and Executive Secretary J. L. Butt attended as the United States delegation.

During his term as president, E. G. McKibben strongly recommended that ASAE join CIGR. However, no action was taken and the Council requested that the writer, during a trip to Europe, investigate the matter further by visiting the association headquarters and further studying the prestige of CIGR among European agricultural engineers.

I visited the office of Armand Blanc, president of CIGR at 15 Avenue du Maine, Paris, France, on July 7, 1960, and was graciously welcomed by Messrs Blanc and Michel Carlier, chief engineer of Rural Engineering of the French Ministry of Agriculture (Service du Genie Rural, Dept. of Ministry of Agriculture).

Mr. Blanc was the retired honorary director general of the French government's School of Agricultural Engineering, and is presently serving as master counselor for financial matters. From his card I also noted that he is a member of the French Academy of Agriculture. He gave me the distinct impression of being a sincere, capable and dedicated individual who is contributing much in his endeavors to bring about a strong international organization of agricultural engineers. Mr. Carlier was also associated with the National School of Agricultural Engineering as a sub-director and a professor of the National Institute of Agronomic-Hydraulics. He was a younger, quite active individual who also seemed quite devoted to bringing CIGR into effective operation as the international organization of agricultural engineers.

While visiting the German Agricultural Engineering Experiment Station at Braunschweig, I met with all of the agricultural engineering department heads at this station. I made a definite effort to determine how European agricultural engineers regarded CIGR as an international organization of agricultural engineers. I was told that the German agricultural engineers were quite well impressed with the organization and past efforts of CIGR, but gained the impression that many countries were apparently holding back somewhat to see if ASAE would join. Since ASAE appears to have more members than all of the other national organizations combined, I can well understand this attitude. In spite of the fact that ASAE has not yet joined CIGR, these men indicated that the latter organization has been growing stronger and gaining steadily in acceptance amongst European agricultural engineers. They intimated that German and British activity in CIGR had been somewhat reserved since they were not sure if ASAE would finally join, but felt that if we did, all of the national groups would increase their support of the CIGR organization.

ASAE members who advocate a closer association between ASAE and CIGR than presently have advanced the theory that it would be unfortunate if, through failure on the part of ASAE to participate actively or adequately, present or potential friends — either in the profession of agricultural engineering or in associated industries — should lean toward nations with less sincere motives for stimulation and professional leadership. These relationships, they feel, point to national and international responsibilities beyond normal professional relationships, and in their opinion, these responsibilities, can be discharged best by energetic, deliberate, and persistent seeking of international leadership in agricultural engineering.

A sustained and increasing interchange of information about research organization and methods, research findings, and associated industrial and economic developments; a continuing and adequate translation service with participation by universities, government and industry; and an increase in visits between North Americans, Europeans and agricultural engineers from throughout the world are given as examples of benefits that could be encouraged and fostered through strong support of an international organization of agricultural engineering.

At the ASAE Council meeting at Memphis in December, it was unanimously voted that ASAE join the CIGR as a National Association, subject to ratification by vote of the members. This matter will be included on your next election ballot. Annual dues for our society to join CIGR, which will give each member the benefits of this affiliation, are only $400, or less than the cost of an air mail postage stamp per member.

In consideration of the increasing importance of agricultural engineering in all countries; in recognition of Mr. Blanc and his group's dedicated pioneering efforts in establishing the first international organization of agricultural engineers and their successful operation for a number of years, I strongly recommend that you vote in favor of ASAE joining the Commission Internationale du Genie Rural as a national society member.

LAWRENCE H. SKROMME
Past-President of ASAE

# Characteristics of All-Weather Farm Machine Cabs

***Air conditioning, ventilation, pressurization and heating are factors to be considered in the design of all-weather cabs***

**B. F. Vogelaar**
*Member ASAE*

WHILE this paper discusses the subject as related to cabs for self-propelled combines, the major considerations also apply to cabs for tractors and other self-propelled harvesting equipment, as well as to industrial cab installations.

Operators of self-propelled combines usually work in a hot and dirty atmosphere. However, with the increasing use of the combine to harvest corn, as well as soybeans, maize, and other fall crops, combines also operate during several cool months of the year. For that reason a combine cab should be designed not only around an air-conditioning unit, but should also include consideration of a proper heater installation. There are many combines in operation which are used mainly in the fall harvest, the summer operation in grain harvesting being of less importance. Therefore, while operators would want a heater primarily, a pressurizing and ventilating fan to provide comfort in summer operation was also considered essential.

With these objectives in mind, it was decided to design a combine cab that would provide the following equipment alternatives: *(a)* air-conditioning unit only, *(b)* air-conditioner and heater unit, *(c)* Pressurizing and ventilating fan only, or *(d)* pressurizing and ventilating fan and heater unit. In no case was it intended to supply the cab without at least one unit which included a fan for pressurizing and ventilating the cab.

Our company's program of testing and experimenting with combine cabs began in the late summer of 1957. To determine the general specifications and to explore some of the problems involved, commercially available cabs made by small shops were equipped with automotive-type air-conditioning and heating units. Some of the early problems encountered included excessive infiltration of dust because of no fresh air intake, restricted vision, excessive glare and distortion of vision, undesirable location of evaporator and heater unit, plugging of evaporator core, and heating of engine due to location of condenser core.

There were, of course, many other problems, but they were not basic to the design. Adequate preliminary specifications were established to design an experimental cab with the equipment mentioned above. The following specifications were established:

1 The cab should be pressurized with fresh air
2 The cab should have some ventilation when pressurization is not required
3 Maximum vision should be provided while maintaining a structurally sound cab
4 Heat-treated tinted safety glass should be provided for safety and for maximum protection against glare
5 The aforementioned units or combinations of units should be arranged to accomplish: *(a)* the use of a common intake filter, *(b)* discharging the cool air from the evaporator core in the upper part of the cab, *(c)* discharging the warm air from the heater core in the lower part of the cab, *(d)* circulating air from the pressurizing and ventilating fan around the upper part of the operator's body, and *(e)* filtering recirculated air for the evaporator only
6 A dark floor mat should be provided
7 The appearance of the cab should be pleasing and in keeping with the over-all design of the combine
8 The condenser cooling system should be separated from the engine cooling system
9 The compressor should be mounted to provide accessibility for maintenance and for charging the system
10 The air-conditioning unit should be well proportioned to utilize maximum efficiency of each unit in the system, and it should be capable of maintaining a 30-deg temperature differential in bright sunlight.


**Fig. 1. General design of air-conditioned cab with Dutch door**

Paper presented at the Winter Meeting of the ASAE at Chicago, Ill., December, 1959, on a program arranged by the Power and Machinery Division.

The author — B. F. VOGELAAR — is division head, engineering department, John Deere Harvester Works, East Moline, Ill.

The need for pressurizing the cab with filtered fresh air was established because of the extremely dirty atmosphere in which a combine must often operate. The many controls which must be operated from the cab require openings and each of these includes sealing problems. The pressurization of the cab eliminated the need to seal these openings completely; however, it was necessary to decrease the openings to a minimum. One of the major development problems was to determine the degree of pressurization required. This, of course, was a function of the air intake through the fresh-air filter. This had to be balanced against the total air flow through either the heater or evaporator core. All fresh air circulating through these units with no recirculating air would provide the maximum pressurization but would also prove to be a heavy load on either the heater or evaporator unit as well as the fresh-air filter.

The first approach was to draw in fresh air for the major portion of the air required to circulate through the evaporator core. This produced an excessive heat load on the evaporator. The minimum pressurization requirement was then determined and it was found that a major portion of the air should be recirculated. The pressure required was found to be quite low. The standard established in determining the proper pressurization was to make sure that there was always air moving out of any of the openings, around the clutch pedal, etc.

Those operators with only a small amount of summer work would not, for economic reasons, be interested in air-conditioning. Proper ventilation had to be provided for the non-air-conditioned cab. Two approaches were considered: *(a)* to provide ventilation through windows only or *(b)* to provide a pressurizing and ventilating fan. The first approach was considered unsatisfactory because there would be no protection from the dust and chaff and the main purpose of the cab would be defeated. There would be more visual obstruction, and structural design problems would increase if all windows were made to open.

Basically, the pressurizing and ventilating-fan system was chosen, but with one window on each side and to the rear which could be opened for additional ventilation when wind direction and other conditions allowed. The specification that the cab should have some ventilation when pressurization was not required was thus accomplished. One of these windows is the upper half of a Dutch door. The whole door can be latched open if desired. Fig. 1 shows the general design, with the Dutch door. This also shows the window area which was provided for maximum vision.

The John Deere 95 combine cab has approximately 39 sq ft of glass area, with 35.5 sq ft for the 55 combine. Heat-treated safety glass was used throughout the cab. The lower front glass was positioned as shown to give approximately perpendicular vision, for minimum distortion, when looking at the cutter bar. Tinted glass was specified to decrease sun glare and distortion.

Fig. 2 is a sectional view through an enclosure which was designed to mount the evaporator core, heater unit and ventilating fan to accomplish the requirements outlined under specification 5 above. Since the evaporator unit and the ventilating fan would never be supplied in the same cab, they could occupy the same space. By locating either of them in the upper half of the enclosure, the cool air could be discharged to the upper part of the cab without duct work. This location of the ventilating fan would also cause the air to be discharged directly on the upper part of the operator's body.

Choosing such a location for the evaporator also provides a simple means for placing a filter to clean the recirculated air, as well as the fresh air, before either enters the evaporator core. Filtering the air from both sources was found necessary because the evaporator core is usually moist and any dust entering the cab, while the door is open, would soon find its way to the core if the recirculated air was not filtered. By placing the heater unit below the evaporator unit and angling it as shown, the heated air would be discharged to the lower portion of the cab. This arrangement also provides a recirculating opening and a fresh air filter location equally effective for any of the units.

Some thought was given to an installation using a single fan for three functions, namely, ventilation, evaporator core, and heater core, but this was not adopted, since the arrangement has three main disadvantages: *(a)* the evaporator core and heater core would have to be of special

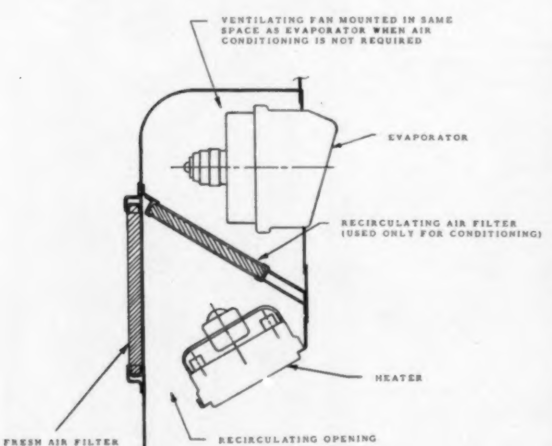


**Fig. 2 Sectional view through enclosure of combine cab**

**Fig. 3 Fresh-air filter is located at side of cab**

matched design since they would have to be mounted in series, *(b)* heated and cooled air would be discharged at the same location, and *(c)* a large fan with a heavy electrical load would be required because of back pressure due to the double-core arrangement. (It is quite easy to exceed the capacity of standard electrical equipment.)

A heavy floor mat was specified to give some insulation and to seal off the clutch and brake pedal openings. Black color was specified to absorb some of the sun glare.

After preliminary investigation it was decided that it was not economically practical to design increased capacity into the combine engine cooling system to allow for the additional heat load of a condenser core mounted in front of the radiator core. Automotive, as well as some industrial-cab, air-conditioning installations do use this arrangement. When a higher percentage of combines are sold with air conditioning, this arrangement may become practical.

The condenser core, receiver unit and compressor were designed into a single unit mounted on the left-hand side of the combine to the rear of the engine, completely separate from the engine except for the drive. This arrangement allowed a condenser fan mounted to the compressor pulley requiring only a single drive. The receiver unit was mounted on the cool air side of the condenser core. This arrangement also provided good accessibility to the compressor for maintenance and charging of the system. The compressor discharge-service valve and suction-service valve are mounted on top of the compressor.

The desired specification of the air-conditioning unit was to maintain a 25 to 30-deg temperature differential in the bright sun. The first installation did not accomplish this. The sun load was much more than expected. By increasing the compressor speed to its optimum speed for the system and providing a larger expansion valve and increased air flow over the evaporator coils, the desired temperature differential was accomplished. In the final design the evaporator fan delivers 325 cfm. The compressor speed is 3,000 rpm on the large 95 combine. The system is rated at 1½ tons maximum capacity.

The basic system consists of an evaporator, condenser and compressor in which a refrigerant is circulated. The rest of the units are refinements added to regulate or improve the operation of the system. They include the following:

- Receiver tank to store surplus freon
- Dryer, to remove moisture from the system
- Sight glass, to observe liquid freon level
- Blower and motor, to bring heated air, both fresh and recirculated, to the evaporator and to discharge the cold air
- Condenser fan, to draw air through the condenser core for increased efficiency of the condenser
- Plumbing, to transport freon, both liquid and vapor, from one unit to another
- Service valves, two used, a compressor discharge-service valve and a compressor suction-service valve, for servicing and charging the system—both manually operated
- Regulating valves, two used and both pressure controlled.

Fig. 6 is a schematic diagram of the system used on John Deere combines and includes all the above-mentioned units. The evaporator with its motor and fan and the expansion valve are mounted in the operator's cab. All of the other units are mounted in one assembly at the left-hand rear side of the combine.

This system does not use an electric clutch on the compressor as do some automotive systems. Therefore, the compressor runs continuously. To regulate the system and to get the desired cooling, a modulator valve, one of the regulating valves mentioned above, is used. This valve, as seen in Fig. 6, is connected to the compressor suction service valve. It has two functions: *(a)* to maintain a minimum pressure in the evaporator, which prevents the evaporator from becoming too cold, and *(b)* to permit vapor to flow from the top of the receiver directly to the compressor, thus by-passing the evaporator and reducing the capacity of the system. The desired temperature is set by a manual

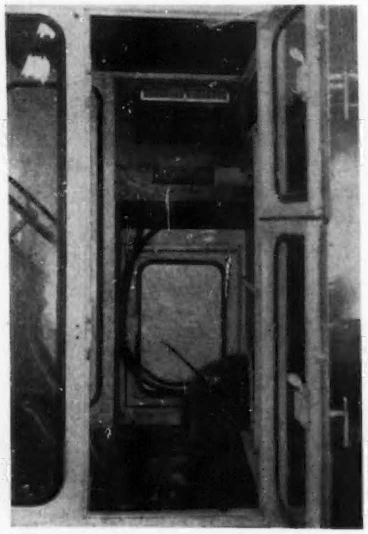

**Fig. 4** *(Left)* Cab is equipped with heater and evaporator combination. Recirculated air filter is inserted in opening in center of panel

**Fig. 5** *(Right)* Cab is equipped with heater and ventilating fan combination

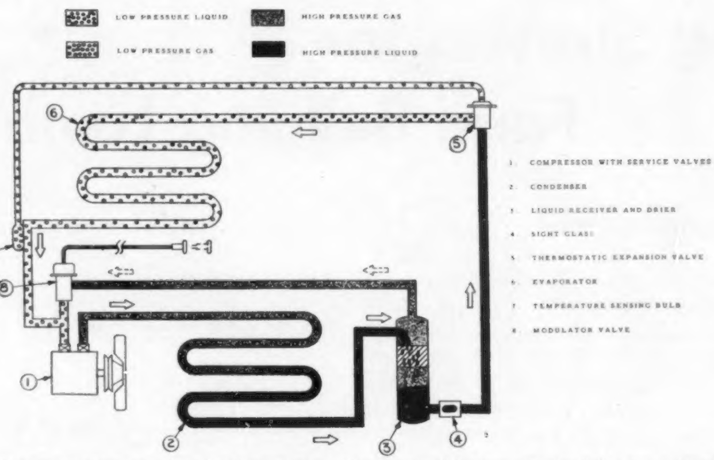


**Fig. 6 Schematic diagram of the basic system used for air-conditioning cabs for John Deere Combines**

control which establishes the minimum pressure by a spring adjustment. The valve is then automatic in operation to maintain this pressure. At full capacity this minimum pressure is such that it will not allow the evaporator to get too cold and freeze. In a well-balanced system the amount of by-pass is small when the control is set at full capacity.

By setting the controls for less cooling, the evaporator pressure is increased and the modulator valve allows more high pressure vapor to by-pass. By setting the controls for no cooling, the modulator valve is held open and the suction of the compressor is open to high-pressure vapor. The compressor is then used only to circulate high-pressure vapor through the condenser and receiver, thus doing very little work.

An expansion valve is the second regulating valve used in the system. The purpose of the expansion valve is to allow the maximum amount of liquid freon to flow into the evaporator without permitting any of the liquid to leave the evaporator. This is done by maintaining some superheat of the vapor near the outlet of the evaporator. A sensing bulb is attached at this point and controls the amount of liquid freon allowed in the evaporator by sensing the superheat pressure (or temperature).

With this method of control, the refrigeration capacity of the system is varied to suit the heat load. High air temperatures over the evaporator tube vaporizes the liquid and superheats the vapor easily and tends to keep the valve open.

Lower air temperatures have difficulty in adding enough superheat and tend to keep the valve closed to allow the vapor to warm up and thus maintain the desired superheat.

Further usage and development work on all-weather cabs will no doubt result in improved design and decreased cost. This will help to make it economically possible for more combines and other self-propelled vehicles to have all-weather cabs as standard equipment. It is hoped that the cab design discussed, which is now on the market, will stimulate further improvements and development.

## National Electrical Week

THE 1961 National Electrical Week will be celebrated February 5 to 11. The all electrical industry event, which marks the birth of Thomas Alva Edison, is held each year during the week of February 11 to focus attention on the contributions that electricity makes to the nation's economy and way of life.

"Make Electricity Work for You" will be the central theme of National Electrical Week, as revealed by Harold A. Webster, president of National Electrical Contractors Assn., and general chairman of N.E.W. Committee. The 1961 observance will again be held in the "umbrella" fashion in which each group within the electrical and allied industries carries out its own program of: telling employees, customers, suppliers and others how important the industry is and how important each of them is to its continuing growth; educating children and adults about electrical safety and electricity's role in history and scientific progress; promoting new business through special campaigns and programs; honoring electrical pioneers and present day leaders; and creating good will among people in the community and across the nation.

A number of observance materials — all incorporating the theme for the week — are being offered through N.E.W. headquarters. These include: planning guides, free reproduction proofs and copy materials, display materials at various prices, Edison replica lamps, television film clips, Electricity in Your Home electrical inspection reports, "How to Make a Simple Electric Motor" pamphlets and other materials. Information and orders may be sent to: National Electrical Week Committee, Suite 306, 407 North 8th St., St. Louis 1, Mo., CEntral 1-1733.

Preliminary reports from participants indicate that the 1961 program will exceed participation in any previous year. At the national level, leading manufacturers are planning salutes to N.E.W. on network television shows and in national magazines. Utilities, contractors, distributors, leagues, electrical workers, and service repair and maintenance groups have planned elaborate local activities to be conducted against the nation-wide backdrop of the week.

The National Electrical Week is sponsored by nine leading trade associations and professional societies and is endorsed by 15 others, including the American Society of Agricultural Engineers.

# Working Stresses for Farm Building Lumber

*Basic information for forming sound judgment on stress levels to be used*

Lyman W. Wood

WOOD is the predominant material in farm-building construction. Agricultural engineers specializing in farm structures rightly give much attention to the working stresses for wood. The Forest Products Laboratory has an interest in the structural use of wood with maximum economy and satisfaction, and has taken an active part in the study of working stresses. This paper reports the Laboratory's views on working stresses, with particular reference to their application in farm building design. It does not specify the working stresses for lumber that should be used in farm building design. It does, however, give information on working stresses, with possible applications in farm buildings. With this background, agricultural engineers can make decisions on design stresses, and enjoy a greater degree of confidence that their choice is sound.

Rural structures, in many areas, are subject to the regulation of building codes. Most codes specify working stresses. The specified stresses are law, and any judgment exercised by the designing engineer must be within the framework of that law. It is thus important that the engineer does his part in the development of those building laws that may control his designs.

This discussion is intended to apply to all farm buildings, except dwellings, including barns and storage structures for farm produce or equipment, or similar structures to which an engineering design may be applicable. Principles and applications of structural design of dwellings are well known and widely used; there is no reason why standards should be different for rural than for urban homes.

### Derivation of Working Stresses

Two principal and basically different methods are used in this and several other countries for arriving at working stresses for structural design with lumber. One is the method of basic stresses, while the other is the method of strength surveys.

The method of basic stresses is currently the standard (1)* in the United States and is used also in Canada and Australia. The basic stress for a species of wood is the safe working stress for clear wood of that species. Average strength values of clear wood are converted to basic stresses by applying suitable reduction factors that provide a factor of safety and reflect the differences between the conditions of laboratory test and those of structural use. The basic stress is multiplied by a strength ratio to obtain a working stress. The strength ratio represents the effects of natural characteristics, such as knots or cross grain, that reduce the strength of clear wood. Thus, if the allowable knot in a structural grade reduces the strength of clear wood by 30 percent, the strength ratio for that grade is 70 percent. Tables of strength ratios for various strength-reducing characteristics applicable to all species have been developed and are published by the American Society for Testing Materials (1). The basic stress is a species constant, independent of grade. The basic-stress method is most useful where diverse and changing lumber grades exist. By using the published tables of basic stresses and strength ratios (1),

TABLE 1. ASTM BASIC STRESSES FOR CLEAR LUMBER UNDER LONG-TIME SERVICE AT FULL DESIGN LOAD[1]

(For use in determining working stresses according to grade of lumber and other applicable factors)

| Commercial Names for Lumber[2] | Extreme Fiber in Bending or Tension Parallel to Grain, psi | Horizontal Shear, max, psi | Compression Perpendicular to Grain, psi | Compression Parallel to Grain, psi ($L/d$ = 11 or Less) | Modulus of Elasticity in Bending, psi |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| **Softwoods** | | | | | |
| Baldcypress (cypress) | 1900 | 150 | 220 | 1450 | 1 200 000 |
| Cedar: | | | | | |
| Alaska | 1600 | 130 | 185 | 1050 | 1 200 000 |
| Atlantic white (southern white cedar) and northern white | 1100 | 100 | 130 | 750 | 800 000 |
| Port Orford | 1600 | 130 | 185 | 1200 | 1 500 000 |
| Western red cedar | 1300 | 120 | 145 | 950 | 1 000 000 |
| Douglas fir: | | | | | |
| Coast type, medium-grained | 2200 | 130 | 235 | 1450 | 1 600 000 |
| Coast type, close-grained | 2350 | 130 | 250 | 1550 | 1 600 000 |
| Rocky Mountain type | 1600 | 120 | 205 | 1050 | 1 200 000 |
| All types, dense | 2550 | 130 | 275 | 1700 | 1 600 000 |
| Fir: | | | | | |
| Balsam | 1300 | 100 | 110 | 950 | 1 000 000 |
| California red, grand, noble, and white | 1600 | 100 | 220 | 950 | 1 100 000 |
| Hemlock: | | | | | |
| Eastern | 1600 | 100 | 220 | 950 | 1 100 000 |
| Western (West Coast hemlock) | 1900 | 110 | 220 | 1200 | 1 400 000 |
| Larch, western | 2200 | 130 | 235 | 1450 | 1 500 000 |
| Pine: | | | | | |
| Eastern white (northern white), ponderosa, sugar, and western white (Idaho white) | 1300 | 120 | 185 | 1000 | 1 000 000 |
| Jack | 1600 | 120 | 160 | 1050 | 1 100 000 |
| Lodgepole | 1300 | 90 | 160 | 950 | 1 000 000 |
| Red (Norway pine) | 1600 | 120 | 160 | 1050 | 1 200 000 |
| Southern yellow, medium-grained | 2200 | 160 | 235 | 1450 | 1 600 000 |
| Southern yellow, dense | 2550 | 160 | 275 | 1700 | 1 600 000 |
| Redwood | 1750 | 100 | 185 | 1350 | 1 200 000 |
| Close-grained | 1900 | 100 | 195 | 1450 | 1 200 000 |
| Spruce: | | | | | |
| Engelmann | 1100 | 100 | 130 | 800 | 1 000 000 |
| Red, white, and Sitka | 1600 | 120 | 185 | 1050 | 1 200 000 |
| Tamarack | 1750 | 140 | 220 | 1350 | 1 300 000 |
| **Hardwoods** | | | | | |
| Ash: | | | | | |
| Black | 1450 | 130 | 220 | 850 | 1 100 000 |
| Commercial white | 2050 | 185 | 365 | 1450 | 1 500 000 |
| Aspen, bigtooth and quaking | 1300 | 100 | 110 | 800 | 800 000 |
| Beech, American | 2200 | 185 | 365 | 1600 | 1 600 000 |
| Birch, sweet and yellow | 2200 | 185 | 365 | 1600 | 1 600 000 |
| Cottonwood, eastern | 1100 | 90 | 110 | 800 | 1 000 000 |
| Elm: | | | | | |
| American and slippery (soft elm) | 1600 | 150 | 185 | 1050 | 1 200 000 |
| Rock | 2200 | 185 | 365 | 1600 | 1 300 000 |
| Hickory, true and pecan | 2800 | 205 | 440 | 2000 | 1 800 000 |
| Maple, black and sugar (hard maple) | 2200 | 185 | 365 | 1600 | 1 600 000 |
| Oak, commercial red and white | 2050 | 185 | 365 | 1350 | 1 500 000 |
| Sweetgum (gum, red gum, sap gum) | 1600 | 150 | 220 | 1050 | 1 200 000 |
| Tupelo, black (black gum) and water | 1600 | 150 | 220 | 1050 | 1 200 000 |
| Yellow-poplar (poplar) | 1450 | 130 | 160 | 1050 | 1 200 000 |

[1]These stresses are based on the strength of green lumber and are applicable, with certain adjustments, to lumber of any degree of seasoning, or lumber used under any conditions of duration of load. These stresses are published in Table VIII of ASTM D245-57T, "Tentative Methods for Establishing Structural Grades of Lumber."

[2]In accordance with the Nomenclature of Domestic Hardwoods and Softwoods (ASTM Designation: D1165), the commercial names for lumber represent recommended commercial practice.

Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Columbus, Ohio June 1960, on a program arranged by the Farm Structures Division.

The author — LYMAN W. WOOD — is head of the section of structural utilization, Forest Products Laboratory, Forest Service, USDA, Madison, Wis.

*Numbers in parentheses refer to the appended references.

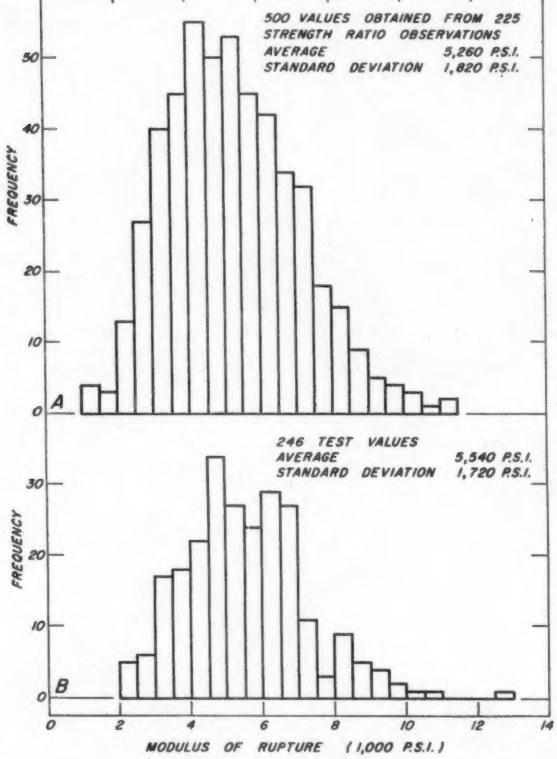


**Fig. 1 Frequency distributions of bending strength values from two strength surveys: (A) strength values from a visual survey of strength ratios in ungraded red oak, 2 x 8, in the northeastern United States; (B) strength values from tests of Douglas fir joists of common structural grade at the Forest Products Laboratories of Canada**

it is possible to assign a working stress to a new grade of lumber without making any strength tests of pieces from that grade. Table 1 is a table of basic stresses originally published by the American Society for Testing Materials (1).

The method of strength surveys approaches working stresses more directly and is used in some of the European and other foreign countries. When a grade of lumber is established, a representative sample is strength tested. The test values are converted to working stresses by applying reduction factors similar to those used in the method of basic stresses. This reduction gives a working stress without the use of basic stresses or strength ratios. In a modification of the strength-survey method, the representative sample of a grade is surveyed visually for strength-reducing characteristics. The frequency distribution of strength ratios thus obtained is combined with the known frequency distribution of clear wood strengths to give an estimated frequency distribution of grade strength values. In some instances, a small percentage of pieces in the visual survey may be strength tested for verification of the estimated strength ratios. This modified strength-survey method is described in recent papers by Wood (4) and by Snodgrass (3). Fig. 1 shows frequency distributions of bending-strength values from a visual survey of strength ratios and from strength tests of a large and representative sample.

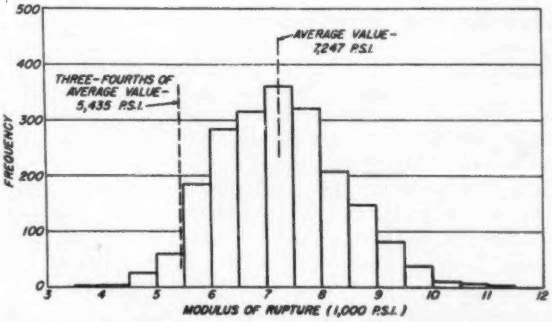


**Fig. 2 Frequency distribution of bending strength in 2,038 small, clear specimens of green Douglas fir. The value of 5,435 psi is a near minimum which excludes about 5 percent of the individual values**

While either the basic-stress or the strength-survey method can be used to arrive at working stresses, the basic-stress method has the advantages of acceptance by a national standardizing body (1) and of wide understanding and use by timber engineers. This paper is limited to the application of the basic-stress method to farm building design.

## Factors in Working Stresses

The principal reduction factors applied to the average strength value of clear wood to obtain the basic stress are those for variability, duration of load, and the factor of safety. Application of a factor for grade (the grade strength ratio) to the basic stress then gives the working stress for that grade.

## Variability

There is a variability in the strength of clear wood within a species resulting from natural differences in the growth of individual trees. Fig. 2 shows a frequency distribution of bending strength in small clear specimens of green Douglas-fir. A near-minimum strength value that is ¾ of the average value (Fig. 2) is widely used in working stress calculations to recognize this natural variability; about 95 percent of the individual values of strength are above this near-minimum.

## Duration of Load

Wood has the favorable characteristic of ability to absorb overloads of considerable magnitude for short periods or small overloads for longer periods. Since wood strength

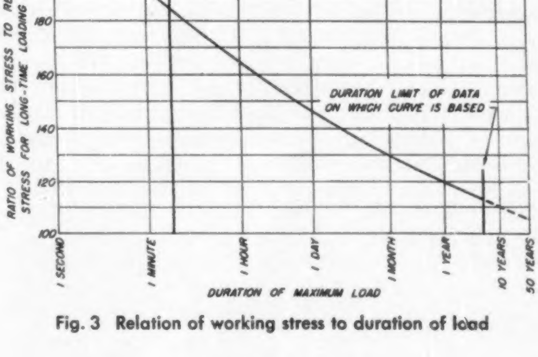


**Fig. 3 Relation of working stress to duration of load**

test values are based on short-time loading, they are reduced to long-time loading conditions in structures by applying a factor of 9/16. The long-time loading stress is then subject to increase for some short-time or intermittent loading conditions (Fig. 3). An increase of 10 percent above the long-time loading stress level is recommended by the lumber industry; it presumes that the continuous or cumulative duration of full design load will not exceed a period of about 10 years during the life of a permanent structure. Larger increases are sometimes made for shorter durations, such as for snow, wind, or earthquake loadings. Stresses for house framing lumber as prescribed by the Federal Housing Administration (2) recognize a 10 percent increase above the long-time loading, but not the larger increases for snow, wind, or earthquake loadings.

### Factor of Safety

A reduction factor of about ⅔ is commonly applied to provide a factor of safety against possible undersize, overload, or other unfavorable condition. A considerable element of judgment enters into this factor, and it is not exactly the same in all species of wood.

### Grade Factor

The grade factor depends upon the strength-reducing characteristics, such as knots or cross grain, that are permitted in a grade of lumber. Tables of strength ratios for various characteristics are published by the American Society for Testing Materials (1). These are applicable to all species. Analysis of structural timber test data indicates that the true strength ratio is, on the average, about 10 percent higher than the values indicated in the tables. Because of variability in the effects of characteristics having the same measurements, a small proportion of lumber has strength ratios slightly below the tabulated values. Most structural grades have minimum grade strength ratios in the range of 50 to 75 percent, while ungraded lumber may have occasional strength ratios as low as 10 percent.

### Safety in Working Stresses

With the application of factors of ¾ for variability, 9/16 for duration of load, ⅔ for the factor of safety, and a grade factor between ½ and ¾, a working stress may be only about ⅕ of the average strength value of clear wood. This, however, does not mean that there is a factor of safety of 5 in the working stress. Much of the reduction from average clear-wood strength to working stress is necessary to convert from the conditions of laboratory test to those of structural use, and thus does not contribute to a margin of safety. Safety depends upon factors of use as well as of strength. Since use as well as strength factors vary among individual pieces of lumber in a structural grade, each piece has its own factor of safety, a ratio of its strength to what is actually required of it in use. This ratio of its adequacy (the true factor of safety) is thus multivalued, and is expressible as a frequency distribution rather than as one number. Studies have been made by Wood (5) and others of these strength and use factors and of their combined effects on safety. Such studies lead to an estimated frequency distribution of the true factor of safety associated with a level of working stress commonly specified in building codes. Such a frequency distribution (Fig. 4) indicates that the most probable

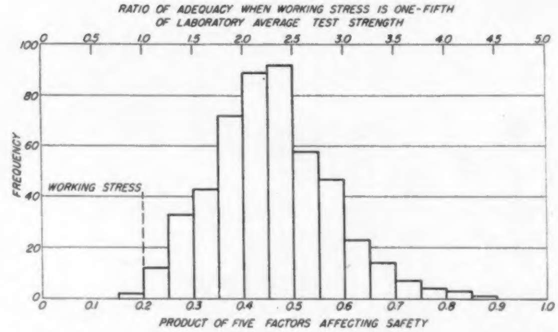


**Fig. 4 Frequency distribution of the ratio of adequacy for a grade, the strength ratio of which is 60 percent, and the working stress is one-fifth of the average clear-wood test strength**

values of the true factor of safety are in the range of 2 to 2½, but that a few values may range above 4 or below 1. A value below 1 means that the piece with which it is associated will fail.

A frequency distribution of the true factor of safety may be analyzed for the probability of failure associated with any working stress level. In Fig. 4, for example, the lower horizontal scale represents a combination of five factors affecting safety, each having its own estimated frequency distribution. The five factors in this instance are variability of clear wood, range of strength-reducing characteristics in a grade, minor factors affecting strength, duration of load, and ratio of actual to expected load. Each of these has been converted to terms related to the average strength of clear wood, and their combination as measured by the lower horizontal scale is in the same terms. A working stress ⅕ of the average clear-wood strength is shown as a short broken vertical line at an abscissa of 0.2 on the lower scale. The upper scale is directly proportionate to the lower scale but with an abscissa of unity at the working stress. The area to the left of the broken line that represents the working stress can be calculated in proportion to the total area under the frequency distribution diagram to show the probability of failure. In this instance, the probability of failure has been estimated at 0.5 percent, or 1 chance in 200. Any other working stress level can be placed on the same diagram, a different upper horizontal scale can be drawn, and a different probability of failure estimated in the same way.

An analysis of this kind recognizes factors of safety that may be present in the assumed loadings as well as in the strength values. In this way, safety from conservative load assumptions can be taken into account as an addition to the safety from the strength values.

### Load-Sharing Members

Many farm structures are built with closely spaced load-carrying framing members, such as joists or studs 12, 16, or 24 in. apart. The floor or wall covering accomplishes some distribution of load among adjacent framing members. If one member is weak, the chances are that the two adjacent members are stronger and that the three combined will redistribute and carry the load without failure of any of them. This is the load-sharing concept. It has been discussed extensively (3), and has been accepted by the Canadian Standards Association, though not yet by an equivalent standardizing body in the United States.

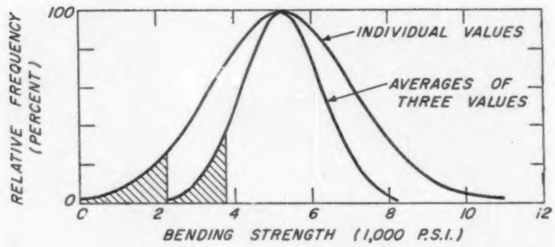


**Fig. 5 Normal frequency-distribution curves of bending-strength values in ungraded red oak, 2 x 8, on the individual and the average of three bases. Crosshatched areas comprise 5 percent of the area under each curve**

Acceptance of the concept of closely spaced load-sharing members means that the working stress can be related to a frequency distribution, not of individual pieces but of the average of any three pieces. Since the variability is thereby reduced, a working stress related to a lower range of strength values is increased. This can be seen in Fig. 5, which shows normal frequency distribution curves fitted to the strength values in ungraded red oak, 2 x 8, that were used in the frequency diagram of Fig. 1(A). One curve shows the frequency distribution of individual values, and the other shows the frequency distribution of the averages of three of the same values. Crosshatched areas represent 5 percent of the areas under each curve, and the abscissae terminating the crosshatched areas are thus 5 percent exclusion values corresponding approximately to the near-minimum strength value shown in Fig. 2. The strength value at 5 percent exclusion is considerably higher in the average-of-three curve than in the individual-values curve. This particular group of values was more variable and thus showed more gain from the average-of-three concept than was the case in most of the other groups that have been examined.

## Working Stresses for Farm Structures

Some of the factors in working stresses may be considered differently for farm buildings than for general building use.

Variability is recognized in connection with basic stresses (1) by considering a strength value at a level of ¾ of the average strength. The basic stresses presume that each structural member will carry its own load. If the concept of closely spaced load-sharing members is applicable, less variability may be assumed (Fig. 5). Studies of frequency distributions of strength values in various grade groups of lumber have been made for the purpose of indicating what increase of working stress may be made in recognition of the lesser variability. The increase is greatest in those groups with an initially great variability, and is greater at the 1 percent exclusion level than at the 5 percent exclusion level (Fig. 5). An increase of 10 percent for load-sharing members of all grades is recognized in Canada. The use of mixed grades or of partially graded or ungraded lumber in farm buildings may tend to result in an initially greater variability of strength compared to that in urban buildings. If this is true, an increase of as much as 20 percent for load-sharing members may be appropriate. If load sharing is assumed in this way, a strength value at a level of 9/10 rather than ¾ of the average value would be considered in deriving working stresses. Acceptance of the load-sharing concept and a corresponding stress increase implies that an occasional joist or stud may break, but that load can be carried by adjacent framing members until repairs can be made.

The strength of wood in long-time loading is generally taken to be about 9/16 of the 5-minute strength as in a standard laboratory test (Fig. 3). An increase of 10 percent, as recommended by the lumber industry for "normal loading," would make the loading factor very nearly ⅝. This same increase is used by the Federal Housing Administration in calculating allowable stresses for all residential framing lumber. Loading conditions in farm buildings are fully as severe from the standpoint of duration as they are in housing. Some engineers, however, may prefer not to take the 10 percent increase for "normal loading."

Working stresses as generally published are for lumber in the green condition or partially dried as in most covered structures. Where 1- or 2-inch lumber is dried to 15 percent or lower moisture content before being dressed to size and remains continuously dry in service, increases of working stress are made as follows: ¼ in bending or tension parallel to grain, ⅛ in horizontal shear, ½ in compression perpendicular to grain, ⅜ in compression parallel to grain, and 1/10 in modulus of elasticity. These increases are not applied to the heavier timbers because the gain in strength with drying is largely offset by the development of seasoning checks or other defects. Stress increases for drying of 1 or 2 in. lumber may be made where they are applicable in farm building design.

## Illustrative Example

The operation of the factors in working stresses may be illustrated by examples of working stresses for general building design and for farm building design. The examples are illustrative only, since engineering judgment enters into any working stress determination and the factors given are representative, but not exact.

Assume a grade with a bending strength ratio of 60 percent in a species having an average modulus of rupture (of clear green wood) of 7,500 psi. For general construction, the reduction factors applied might be ¾ for variability, ⅝ for "normal loading," ⅗ for the grade strength ratio, ⅔ for other factors, and no increase for drying. Therefore, $7{,}500 \times \frac{3}{4} \times \frac{5}{8} \times \frac{3}{5} \times \frac{2}{3} = 1{,}406$ psi working stress in bending.

Consider the same grade for farm building design. The engineer might use 9/10 for variability in load-sharing members, ⅝ for duration of load, ⅗ for grade factor, and ⅔ for other factors. Then $7{,}500 \times \frac{9}{10} \times \frac{5}{8} \times \frac{3}{5} \times \frac{2}{3} = 1{,}688$ psi working stress in bending. Based on the assumption that the lumber was dried before being dressed to size and would remain dry in service, an increase of 25 percent would be applicable, making the working stress 2,110 psi. This could be rounded off to 2,100 psi for ease of use in design. If a substantial factor of safety was believed to be in the assumed loadings, the ratio of ⅔ for other factors (including a margin for overload) could be increased accordingly, giving a higher working stress.

## Safety in Farm Building Design

The factor of safety and the probability of failure may be fruitful fields for study in farm building design. Analysis of existing buildings and correspondence with agricultural engineers lead to the belief that much of the present-day design and construction of farm buildings is with working

*(Continued on page 25)*

# Seed Cleaning by Electrostatic Separation

***When devices, depending upon size, shape, length, specific gravity, coat texture, terminal velocity or color of matter, fail to separate similar seed varieties, the seed's own ability to conduct electricity distinguishes it from other species***

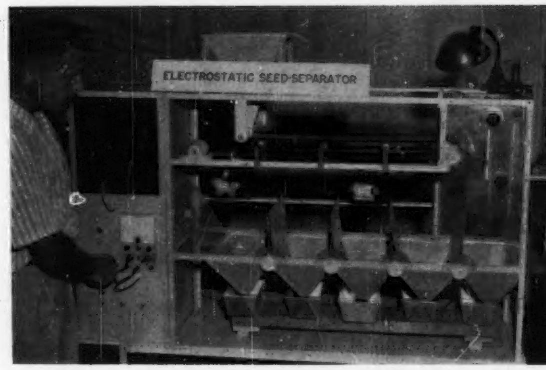


Fig. 1 Electrostatic separator used in seed-cleaning research at Oregon State College

**J. E. Harmond, N. R. Brandenburg, and D. E. Booster**
*Member ASAE* *Assoc. Member ASAE* *Member ASAE*

THE production of field crop seeds is an important industry in the United States. Approximately 150 kinds of agricultural seeds are produced which are valued at more than $300 million annually. This does not include vegetable crops and flower seeds. In addition, the United States imports another $15 million worth of crop seeds. The commercial value of seed is a function of its grade and quality. Consequently seed cleaning is a very important phase in the over-all production of field crop seeds.

Seed cleaning involves the removal of contaminating material from the crop seed. The presence of such things as weed seed, rocks, chaff, clods, insect and animal excreta, or other crop seed can definitely reduce the quality of a seed lot. For example, planting seed containing weeds can result in reduced yields and increased production costs. The far-reaching effects of the weed seed do not end here, however. Land values may be reduced because of infestation with certain weeds. Even the health of man and animals may be affected by the presence of some weeds. Also to be considered is the reduction in quality of any products that are manufactured from the seed produced. Federal and state seed laws specify the permissible tolerances for contaminating materials in crop seeds that may be transported and marketed. Some weeds are so objectionable that not even one weed seed is permitted.

Some sort of cleaning operation is usually required for a seed lot to meet minimum standards. New and improved techniques for seed cleaning are constantly in demand. The commonly used methods of cleaning are based on physical differences between the crop seed and the contaminating material. Commercial seed cleaners are available that make separations based on size, shape, length, specific gravity, seed coat texture, terminal velocity, and color. The greater the difference between particular properties of a crop seed and its contaminant, the easier will be the separation. Unfortunately there is not enough difference in physical characteristics of seeds in some mixtures for existing machines to make a separation. Therefore, some other physical property of the seed must be utilized in order to effect a separation of these mixtures. With small seeds, electrostatic separation is essentially independent of such things as size, shape, weight, and surface texture. It depends upon the ability of a seed to conduct an electrical charge.

The principle employed in the electrostatic separation process was known to man as early as 600 B.C. The Greeks discovered that lightweight materials, such as strands of hair and dust particles, could be attracted to a piece of amber which had been rubbed with fur. The amber, thus treated, was charged with static electricity. It was not until 1600 A.D. that it was discovered that materials other than amber had the ability to accumulate a static charge (9)*. Not until the latter part of the nineteenth century do the records show that man made practical use of this phenomenon.

The first commercial electrostatic separator was developed and patented by Thomas B. Osborne of New Haven, Conn., in 1880. It is interesting to note that Osborne's machine was made specifically for processing an agricultural commodity. The function of this machine was to remove chaff and other lightweight material which reduced the quality of flour. The contaminating material was attracted or "lifted" out of the flour by a charged, hard-rubber roll. The electric charge was produced in this machine, as it was in most early electrostatic separators, by friction (11). In 1881, the first commercial electrostatic minerals separator was patented. Since that time, electrostatic separation has been used primarily in the mining industry. Today there are more than 200 United States patents on electrostatic separators of one kind or another. Only a few of these were designed specifically for seed cleaning. At present, there are several makes of electrostatic seed separators receiving limited use by the seed industry.

Very little publicity has been given to the application of electrostatic separation in the cleaning of agricultural seeds; however, some of the successful electrostatic separations of agricultural products on record are shown in Table 1.

Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Columbus, Ohio, June 1960, on a program arranged by the Electric Power and Processing Division. Approved as miscellaneous paper No. 102 of the Oregon Agricultural Experiment Station, Corvallis.

The authors — J. E. HARMOND, N. R. BRANDENBURG, and D. E. BOOSTER — are, respectively, principal agricultural engineer and agricultural engineer, small seed harvesting and processing investigations (AERD, ARS), USDA, and assistant professor of agricultural engineering, Oregon State College, Corvallis.

*Numbers in parentheses refer to the appended references.

TABLE 1. ELECTROSTATIC SEPARATIONS

| Cleaned Product | Contaminating Material Removed |
|---|---|
| Alta fescue | Cheat, ryegrass bachelor's button (3,7) |
| Bentgrass | Ergot (12) |
| Bluegrass | Canadian thistle |
| Brome | Wild oats (7) |
| Clover | Curly dock, lambsquarter, pigweed, sheep sorrel (7) |
| Coffee, ground and roasted | Chaff (4) |
| Cocoa nibs | Shells and bark (4) |
| Corn | Insect and animal excreta, chaff (1) |
| Mustard seed | Insect and animal excreta (10) |
| Raisins | Leaf and stem material (2) |
| Rice | Water cress (2) |
| Ryegrass, common | Bachelor's button (3) |
| Ryegrass, perennial | Bachelor's button (3) |
| Vetch | Wild garlic |

Research on electrostatic separation has been carried on mainly by individuals connected with the mining industry and by the U.S. Bureau of Mines at its College Park, Md., station. There is still much to be learned about the phenomena involved in electrostatic separation. This is evidenced by its rather limited use. However, because of the strict requirements of the seed trade, no separation method can be overlooked. The great possibilities offered by electrostatic separation for cleaning hard-to-handle seed mixtures warrant further study.

To investigate electrostatic seed-cleaning applications, an experimental machine has been developed at Oregon State College, Corvallis. Design, construction and testing of the unit has taken place through the cooperation of the Oregon Agricultural Experiment Station and the Small Seed Harvesting and Processing Investigations, Agricultural Engineering Research Division, U.S. Department of Agriculture. The unit consists essentially of a feed hopper, a conveyor belt, a 25,000-volt, direct-current power unit rated at 90 microamperes, a beam-type electrode, and adjustable dividers (Fig. 1). The electrode is made up of a ¾-in. diameter aluminum tube and a 0.012-in. diameter tungsten wire which are parallel to each other and in electrical contact.

In operation, seeds are metered from the hopper to the belt and are conveyed into an electric field surrounding the electrode where they become charged. A given seed tends to hold or lose charge according to its electrical conductivity. Depending upon field characteristics and the charge on the seed, some seeds are repelled by the electrode and tend to stick to the moving belt for a short time. In other cases, the forces present in the field deflect the seeds toward the electrode.

When the electrode is rotated so that the wire is between the tube and the belt, a discharging or "pinning" field is created (5). Seeds passing through this field are sprayed with electrons and become negatively charged by conduction as shown in Fig. 2. The better conductors of a seed mixture will lose their charge and fall in a normal discharge pattern from the belt. Seeds that are relatively poor conductors will adhere to the belt, as shown, until their charge is neutralized.

If the electrode is positioned with the tube between the wire and the belt, a static or "lifting" field is produced. When seeds pass through this field, they receive a positive charge by induction (Fig. 3). With seeds that are good conductors, the positive and negative charges already present tend to migrate on the seed surface as shown. Positive charges assume a position nearest the negative electrode, and negative charges (electrons) accumulate at or near the seed surface contacting the belt. Free electrons of the seed move to the belt, leaving the seed with a net positive charge. A force of attraction then exists between the seed and the electrode causing the trajectory of the seed to be shifted toward the electrode. Poor conductors, because they resist the charge migration, are relatively unaffected and drop normally from the belt.

With the proper combination of such variables as field characteristics, voltages, divider positions, and feed rates, many seed types can be separated according to their electrical conductivities. Fortunately, from a separation standpoint, no two seeds are exactly alike. There may be slight differences in surface texture, shape, weight, or appendages. Even though no physical differences are apparent, there still may be variations in chemical makeup. Any of these factors may affect electrical characteristics of seed and therefore influence separation possibilities.

Electrostatic seed separation research at Oregon State College has had several objectives. They are: *(a)* determining the effect of high voltage exposure upon seed germination, *(b)* studying the influence of seed moisture content upon seed separation, *(c)* investigating electrical field characteristics for several electrode positions, *(d)* adding to the list of seed mixtures that can be separated electrostatically, and *(e)* measuring electrical conductivity of seeds as a means of predicting separation possibilities.

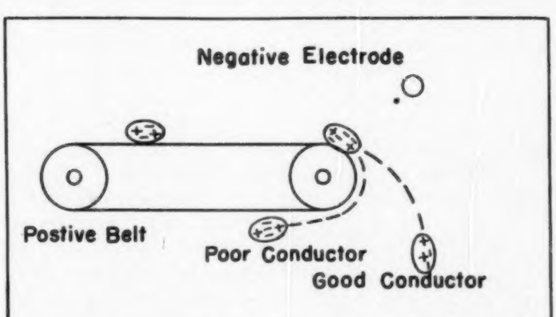


**Fig. 2 Discharging field in which seeds receive a charge by conduction**

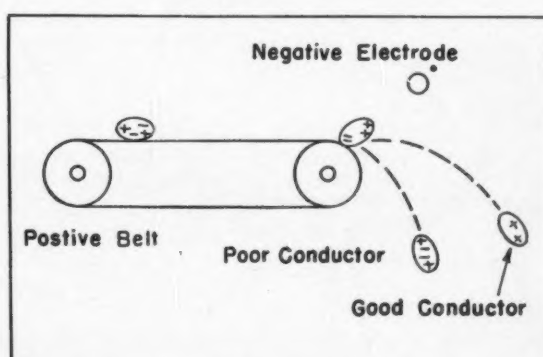


**Fig. 3 Static field in which seeds receive a charge by induction**

## . . . Seed Cleaning

High-voltage exposure was studied by subjecting Chewings fescue, ryegrass and subterranean clover to voltages ranging from 10,000 to 45,000 volts in 5,000-volt increments (6). In another test, samples of seed were exposed fifty or more times to voltages up to 25,000 volts. The seeds tested were bachelor's button, ladino clover, red clover, Dutch white clover, alfalfa, common and perennial ryegrass, creeping red fescue, and alta fescue. All exposed seed lots and untreated control samples were then germinated in an official seed testing laboratory. A statistical analysis showed no significant differences between the germination results of exposed and control samples.

To determine the influence of seed moisture content upon seed separation, tests were carried out in a room with controlled temperature and humidity. It was found that an increase or decrease in moisture content of 3 percent (dry basis) definitely reduced separation efficiency. Even though seed moisture is influential, there is some evidence that moisture changes can be compensated for, to some extent, by varying the voltage, electrode position, or divider settings.

Since the electric field surrounding the energized electrode is of basic importance in electrostatic separations, an analog field plotter was used to obtain two-dimensional plots of fields for various electrode positions. Figs. 4, 5, and 6 show, respectively, field patterns for the lifting, pinning, and combination positions (3). As determined by experiment, any of these positions or other intermediate electrode rotations may be required for optimum separating results.

As indicated in Table 1, various electrostatic separations of agricultural products are now on record. Attempts have been made, in the Oregon State College research, to duplicate some of the separations and to enlarge this list. Separations that have shown promise are curly dock from red clover, bachelor's button from common and perennial ryegrass, sheep sorrel from alsike clover, sandbur from alfalfa, bachelor's button from alta fescue and crested wheatgrass, chervil from ryegrass, wild radish from crimson clover, and red clover from lotus.

Preliminary studies have been carried out to obtain some knowledge of relative electrical conductivities of seeds (8). This information should be of value since the electrostatic phenomenon is a function of electric charge which, in turn, is related to seed conductivity. Parallel, horizontal, charged plates were arranged so that the distance between them could be readily changed. Seeds were placed on the bottom plate, and the top plate was lowered until the electrical force of attraction lifted the seeds off the bottom plate. The distance separating the plates at this time was taken as an index of the relative inductive capacities of the seeds and therefore their conductivities. On this basis, curly dock, vetchling, and alfalfa showed low values indicating a short distance between plates. On the other hand, Reed's canary grass, bentgrass, and perennial ryegrass were high in comparison. Preliminary investigations have indicated that two seeds may be separated when there is a substantial difference between the index numbers of the two seeds.

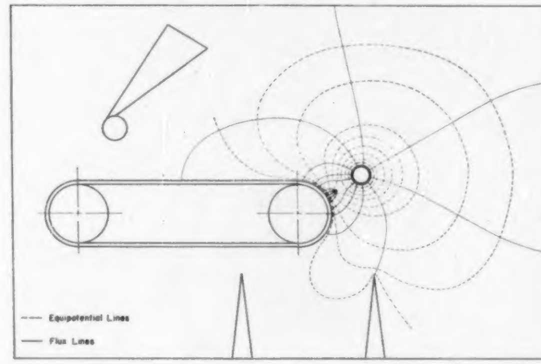


Fig. 5 Field resulting from electrode in the pinning position

The charged plate data were also used in another phase of the work. The voltage and distance separating the plates were determined at the time the electrical force of attraction was sufficient to overcome the weight of a given seed. By making the necessary substitutions in a capacitance equation, this information and seed dimensions permitted the calculation of the induced electrostatic charge on the seed at the time of lifting.

In other tests, the time was determined for a seed to lose a given charge and assume one of opposite polarity. Single seeds were exposed, first, to a discharging field and, next, to a static field. The time required for a seed to lose its initial charge and receive an induced one was taken as another index of seed conductivity.

Since the first commercial machine, much progress has been made in the use of electrostatic separation for cleaning agricultural products. However, more basic knowledge of

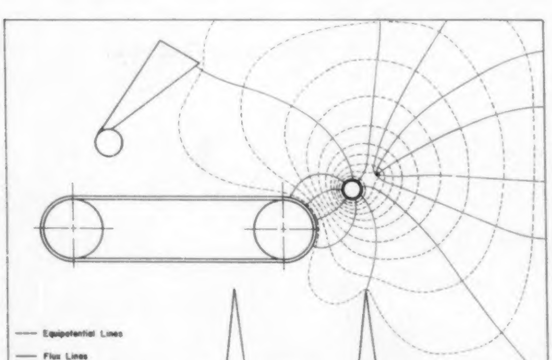


Fig. 4 Field resulting from electrode in the lifting position

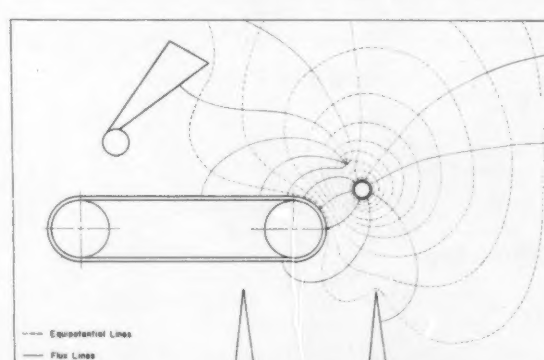


Fig. 6 Field resulting from electrode in the combination position

electrostatic response of seed is needed. With additional research, it is possible that electrostatic separation can realize its full capability; that is, processing seed mixtures which are difficult or impossible to separate with existing equipment.

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## . . . Stresses in Lumber

*(Continued from page 21)*

stresses that are substantially higher than those used in wood construction under presently existing building codes. Are agricultural engineers working with a lower factor of safety than are building officials? This may be partly, but only partly, true. Load-distribution factors are not as well known in rural as in urban buildings. If conservative load assumptions are made in recognition of this circumstance, the margin in the assumed loads may contribute importantly to the true factor of safety. Restraint and redistribution of stress in joints and fastenings may actually reduce stresses and thus increase the factor of safety. Agricultural engineers are giving thought and study to these questions.

A smaller factor of safety and a greater chance of failure of an individual member may be more tolerable in farm buildings than in other structures. A farm work building generally is not open to the public, and public liability is not likely to be involved in a structural failure. In addition, the framing of farm buildings is likely to be fully exposed, so that the owner has a good chance to detect trouble and make repairs before collapse or serious failure occurs. If failure or distress occurs in a stud, joist, or rafter, a load can often be carried temporarily by the adjacent members until the distressed member is repaired or replaced. Framing repairs in farm buildings are relatively cheap.

It appears desirable to make an analysis of factors of strength and use that are particularly appropriate to lumber framing in farm buildings. This analysis would lead to an estimated frequency distribution of the true factor of safety similar to that in Fig. 4. Such a frequency distribution would provide a basis for appraisal of various levels of working stress for factor of safety and probability of failure.

#### Conclusions

The purpose of this paper is to give information on which the agricultural engineer can form a sound judgment on the stress levels to be used rather than to specify working stresses for lumber in farm buildings. The responsibility of the designer is suggested at several points and is important enough to be repeated here. That responsibility need not be taken by any one engineer alone; the Farm Structures Division of the American Society of Agricultural Engineers offers opportunity for committee action.

The subject of working stresses for design is a broad one, and this paper indicates somewhat its complexity. Nevertheless, with the cooperation of producers, users, and research or educational institutions, the various viewpoints can be harmonized, and the objective of safe and economical working stresses for farm building lumber attained.

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## 1961 ASAE Membership Roster

IN order that the latest changes can be made in the 1961 ASAE Membership Roster to appear in the 1961 AGRICULTURAL ENGINEERS YEARBOOK, corrections must be received by February 1. For convenience in making corrections a clipping from the 1960 roster was attached to the 1961 membership dues invoice. Please make any necessary corrections when dues are paid. Those who find it necessary to delay payment of dues beyond February 1, are requested to return the bottom of the invoice with necessary changes.

## Correction

Word has been received that Equation [1] in the article entitled "Four-Wheel Tractor Braking" by K. E. Ryan and C. W. Terry, page 746, November issue, is incorrect. Equation [1] should read as follows:

$$R_t = W \sin\phi\,(h_2/L_2)^{\dagger} + P(h_1/L_2) - (W/g)\,(-a)\,(h_2/L_2) + W\cos\phi\,(L_1/L_2)\;.\quad . \quad . \qquad [1]$$
$$= \Big[[W\sin\phi + W(a/g)]h_2 + W\cos\phi\,L_1 + Ph_1\Big](1/L_2)$$

†This is only approximate since center of gravity and axles are not the same height.

# Critical Tractive Forces in Cohesive Soils

***Studies support theory in evaluating stability in open channel design***

**Ernest T. Smerdon and Robert P. Beasley**
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STABILITY is of great importance in any field of engineering concerned with the design of open channel water conveyance systems. To date the following criteria have governed the design of open channels: the concept of limiting velocities, the regime theory, and the tractive force theory. The first two of these are strictly empirical in nature, while the latter is primarily theoretical in that it offers a way to evaluate shear at the interface of flowing water and the channel bed material. However, for open channels constructed in cohesive soils, the relationship between boundary shear and soil movement has not been adequately determined.

A brief resume of the tractive force theory and its method of application to the problem of stable open channel design is presented on page 30. Also some relationships between critical tractive force in cohesive soils and certain physical properties of the soils are presented. The critical tractive force is defined as that tractive force which causes general movement of the material composing the channel bed.

## Equipment and Procedures

In order to determine some basic relationships between critical tractive force and the physical properties of cohesive soils, a series of tests was outlined. Eleven Missouri soils were selected for testing. These soils were chosen in order to give considerable range in soil cohesion and the ease with which the aggregates disperse in water. The tests included physical tests on the soils to determine their physical properties and hydraulic tests to determine the critical tractive force.

Physical tests included mechanical analysis, plastic limit, liquid limit, voids ratio, aggregate analysis, and specific gravity. With the exception of the aggregate analysis, these tests were performed according to procedures outlined in the American Society for Testing Materials Standards (1)*. The aggregate analysis was performed as follows: A representative sample of each soil was air dried for several days. The sample was then sieved to obtain the fraction between No. 16 and No. 8 sieves of the U. S. standard sieve series. A sample of approximately 50 grams was weighed and placed in a glass graduate, 2.5 in. in diameter and 18 in. in height, which was filled to the 1000-ml (milliliter) mark with distilled water. With one hand carefully pressed over the top of the graduate, it was inverted at 5-sec intervals for 90 sec and then at 1-sec intervals for 30 sec. Hydrometer readings were then made at the end of 15, 30 and 40 sec and 1, 2, 5, 15, 30, and 60 min. The results of the hydrometer tests were analyzed in accordance with the mechanical analysis procedure (1).

Physical properties of the soils which were evaluated included the plasticity index, $I_w$, the dispersion ratio, $D_r$, the mean particle size, $M$, and the percent clay, $P_c$. The plasticity index is the numerical difference between the liquid limit and the plastic limit. The dispersion ratio is the ratio of the total weight of silt and clay sized aggregates to the total weight of silt and clay sized particles (5). For the percent clay determination, the upper limit of clay sized particles was considered as 0.002 mm.

Hydraulic tests of the soils were performed in a hydraulic flume 60 ft long, 2.51 ft wide, and 1.5 ft deep. The total rate of flow through the flume was measured with a calibrated H-type rate measuring flume which provided a continuous record of the flow rate. The flow from the rate measuring flume discharged into a stilling basin attached to the upper end of the hydraulic flume. To aid in dissipating turbulence, baffles were placed in the upper end of the flume just below the stilling basin.

Depths of flow at points along the flume were measured with piezometers attached to the sides of the flume at 12-ft intervals beginning 9 ft from the upstream end of the flume.

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Chicago, Illinois, December 1959, on a program arranged by the Soil and Water Division. Approved for publication by the Director of the Missouri Agricultural Experiment Station as Journal Series No. 2082.

The authors — ERNEST T. SMERDON and ROBERT P. BEASLEY — are, respectively, associate professor of agricultural engineering, Agricultural and Mechanical College of Texas, College Station, and professor of agricultural engineering, University of Missouri, Columbia.

*Numbers in parentheses refer to the appended references.

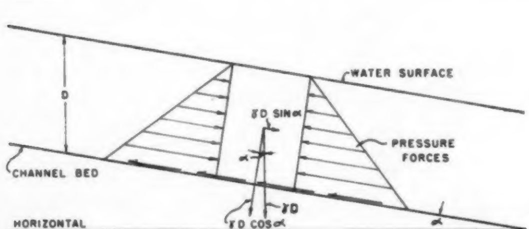


Fig. 1 Tractive Force diagram

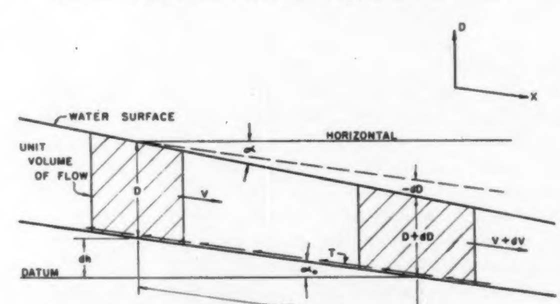


Fig. 2 Non-uniform flow diagram

## TRACTIVE FORCE THEORY

The tractive force theory originally was introduced by Du Boys who presented an equation which evaluated the tractive force of flowing water from the geometry of the channel and water surface profile (4). The method entailed the evaluation of forces that must act on any free body of water within the channel. A free body of water of unit width and length as shown in Fig. 1 is considered for an open channel of infinite width with uniform flow. In order that this free body might be in equilibrium, the summation of forces acting on it must be zero. These forces consist of the weight of the free body, the pressure forces acting on the sides of the free body, and the boundary shear of the moving water. Resistance to flow offered by the air above the water is ignored. Pressure forces are merely opposed by similar forces on the opposite side of the free body, and the component of weight normal to the channel bed, $\gamma D \cos \alpha$, where $\gamma$ is the specific weight of water, is opposed by the bed itself. However, the component of weight parallel to the channel bed, $\gamma D \sin \alpha$, is opposed by the boundary shear of the moving water. This boundary shear is the tractive force, $T$.

Thus, the tractive force is given by

$$T=\gamma D \sin \alpha \quad . \; . \; . \; . \; . \; . \; . \quad [1]$$

However, the slope of the channel, $S$, is equal to $\tan \alpha$, and for small values of $\alpha$, $\tan \alpha = \sin \alpha$. Finally

$$T=\gamma DS \quad . \; . \; . \; . \; . \; . \; . \; . \quad [2]$$

Equation [2] is applicable only when the flow in the channel is uniform.

For nonuniform flow, the force parallel to the channel bed which occurs as a result of the accelerating or decelerating flow must be considered. This can be done by modifying Equation [2] according to the principle of conservation of energy. The total energy at one section is equal to the total energy at a section downstream plus the work required to overcome the boundary shear of the water in moving the distance between the sections.

Referring to Fig. 2, the energy relationship is

$$(V^2/2g)+D+dh=[(V+dV)^2/2g] + D + dD + (T/\gamma D)\, dx \quad . \; . \quad [3]$$

where $V$ is the mean velocity of flow and other symbols are as given in Fig. 2. By ignoring $(dV)^2$ which is small compared to $2VdV$, $T$ is given by

$$T=\gamma D\, [-(V/g\; dV/dx) - (dD/dx)+(dh/dx)] \quad . \; . \; . \quad [4]$$

But $\sin \alpha_o = dh/dx$, and for small $\alpha_o$, $\sin \alpha_o = \tan \alpha_o = S$, where $S$ is the channel slope. Therefore

$$T=\gamma D\, [-(V/g\; dV/dx) - (dD/dx)+S] \quad . \; . \; . \; . \; . \; . \quad [5]$$

Furthermore, from continuity

$$V=q/D \text{ and } dV/dx = -(q/D^2\; dD/dx) \quad . \; . \quad [6] \text{ and } [7]$$

where $q$ is the channel discharge per unit width. Using Equations [6] and [7], Equation [5] becomes

$$T=\gamma D\, \{[(q^2/gD^3)-1] (dD/dx)+S\} \quad . \; . \; . \; . \; . \quad [8]$$

It should be noted that according to the notation of Fig. 2, $S$ is negative for channels which slope downward in the direction of flow.

The equations presented thus far are only applicable to wide open channels. For narrow channels the tractive force distribution on the channel boundary can be obtained from velocity measurements as follows: Draw isovels (lines of equal velocity) for the cross section of the flowing water. Divide the cross section into subareas by drawing lines which are perpendicular everywhere to the isovels and to the boundary of the channel. Since there is no velocity gradient across these lines, there is no exchange of momentum across them and therefore no net shear. The tractive force acting on the channel boundary part of each subarea is obtained by using the effective depth of the subarea. The effective depth of each subarea is the area of the subarea divided by the length of the channel boundary part of the subarea. This effective depth is substituted for the depth in Equation [2] to get the tractive force at the point in question.

The equations for tractive force presented herein are derived strictly from knowledge of the forces that must act on any free body of water in the channel. However from principles of fluid mechanics it is known that the velocity gradient near a fluid boundary is related to the boundary shear (3). Einstein has derived an equation which gives the tractive force at a fluid boundary in terms of the velocity gradient at the boundary (2). This equation is

$$T=\rho[(V_2-V_1)/5.75 \log_{10} (y_2/y_1)]^2 \quad . \; . \; . \; . \; . \; . \; . \quad [9]$$

where $\rho$ is the fluid density and $V_1$ and $V_2$ are the point velocities at distance $y_1$ and $y_2$ respectively from the boundary. Equation [9] holds only for turbulent flow.

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The velocity distribution in the flume was determined by making point velocity measurements at predetermined points with a Darcy-type pitot-static tube. The differential pressures from the Darcy tube were measured with an inclined differential manometer.

The section of the hydraulic flume where the soil was placed was 18 ft long and was located 30 to 48 ft from the upstream end of the flume. The soil was placed in a layer 2.5 in. thick. Remaining portions of the flume bottom were covered with a concrete fill 2.5 in. thick. At a distance of 39.5 to 44.5 ft from the upstream end of the flume, the sides of the flume were constructed of clear plexiglass sheets. These transparent sides permitted direct observations of the channel bed to be made during the tests.

For the hydraulic tests, each soil sample was carefully leveled but not compacted. The soil was then wetted by slowly admitting water through the flume. Then the flume was drained and the soil permitted to dry for about 20 hr before the test was run. At the start of a test the water was slowly admitted through the flume and all measuring devices primed. The rate of flow was then increased by increments allowing time for the flow to stabilize between each increase in the flow rate. The channel bed was observed through the transparent flume sides to determine the extent of movement of the soil. Observations of the channel bed and all measurements were made after each increase in the flow rate. The process of increasing the flow rate by increments and recording data was continued until general movement of the soil composing the channel bed was observed. This was defined as bed failure. The tractive force corresponding to this condition was considered as the critical tractive force.

The critical tractive force was calculated by Equation [9] and by either Equation [2] or [8]. Equation [2] was used when the flow was uniform at the time of bed failure.

TABLE 1. PHYSICAL PROPERTIES OF SOILS AND CRITICAL TRACTIVE FORCE

| Soil No. | $G_s$ | $L_w$ | $P_w$ | $I_w$ | $D_r$ | M mm. | $P_c$ | e | $T_c$ Eq. (2) or (8) lbs/ft$^2$ | $T_c$ * Eq. (9) lbs/ft$^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.61 | 32.6 | 22.4 | 10.2 | 22.2 | 0.0192 | 15.3 | 1.33 | 0.0199 | 0.0125 |
| 2 | 2.65 | 41.2 | 28.8 | 12.4 | 26.8 | 0.0203 | 17.0 | 1.46 | 0.0328 | 0.0125 |
| 3 | 2.68 | 32.9 | 26.3 | 6.6 | 73.1 | 0.0215 | 16.6 | 1.63 | 0.0153 | 0.0084 |
| 4 | 2.66 | 38.0 | 24.0 | 14.0 | 28.7 | 0.0130 | 24.3 | 1.23 | 0.0281 | 0.0217 |
| 5 | 2.63 | 40.0 | 25.9 | 14.1 | 19.2 | 0.0094 | 30.2 | 1.41 | 0.0458 | 0.0354 |
| 6 | 2.68 | 82.0 | 37.9 | 44.1 | 4.9 | 0.0003** | 57.5 | 1.78 | 0.0886 | 0.0477 |
| 7 | 2.66 | 39.7 | 25.6 | 14.1 | 11.9 | 0.0150 | 22.9 | 1.48 | 0.0325 | 0.0161 |
| 8 | 2.66 | 37.0 | 28.8 | 8.2 | 35.7 | 0.0147 | 16.8 | 1.40 | 0.0225 | 0.0161 |
| 9 | 2.70 | 43.8 | 25.4 | 18.4 | 21.2 | 0.0108 | 30.7 | 1.32 | 0.0241 | 0.0217 |
| 10 | 2.77 | 45.1 | 29.8 | 15.3 | 15.7 | 0.0112 | 24.5 | 1.84 | 0.0384 | 0.0264 |
| 11 | 2.89 | 60.9 | 30.5 | 30.4 | 10.3 | 0.0038 | 44.1 | 1.62 | 0.0546 | 0.0317 |

* Symbols: $G_s$ = Specific gravity, $L_w$ = liquid limit, $P_w$ = plastic limit, $I_w$ = plasticity index, $D_r$ = dispersion ratio, M = mean particle size, $P_c$ = per cent clay, e = voids ratio, $T_c$ = critical tractive force.

** Estimated value from extrapolation of particle size curve.

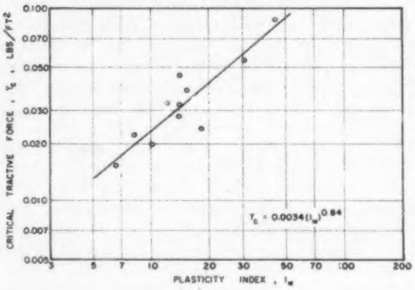



Fig. 3 *(Left)* Critical tractive force determined by Equation [2] or [8] versus the plasticity index

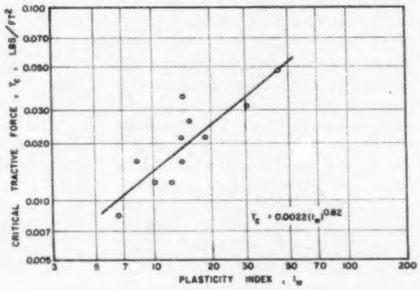



Fig. 4 *(Right)* Critical tractive force determined by Equation [9] versus the plasticity index

Otherwise, Equation [8] was used. In using Equation [9], the velocity profile above the point of bed failure was plotted on semilog paper with depth as the logarithmic scale and velocity as the arithmetic scale. Two points were selected from a straight line drawn through the observed points and their respective values substituted into Equation [9].

## Discussion of Data and Results

Table I contains summarized data from the physical tests and hydraulic tests conducted.

The present study was limited to an investigation of the stability of open channels in cohesive soils, therefore two physical properties were selected which would give a measure of the cohesiveness of the soil. The plasticity index, $I_w$, has been used in the past by soil physicists to measure soil cohesion. The ease with which soil particles are dispersed in water is also a measure of soil cohesion and has been used as an index of the erodibility of soils (5). The ease with which particles are dispersed in water was measured by the aggregate and mechanical analyses and expressed as the dispersion ratio, $D_r$.

The mean particle size, $M$, has been related to critical tractive force in open channels with noncohesive bed materials (4). This value does not measure soil cohesion since soils with different amounts of clay may have the same mean particle size. To evaluate the effect of the clay content of the soils, the percent clay (by weight), $P_c$, was determined.

Data from the physical tests of the soils were plotted versus the critical tractive force on appropriate graphs in an attempt to determine which physical properties show the best correlation with critical tractive force. In every case, the critical tractive force was considered as the dependent variable and plotted on a logarithmic scale. The soil properties were considered to be the independent variables and were either plotted on arithmetic or logarithmic scales, depending on whether a parabola or an exponential equation best fit the data.

In making the statistical analyses of the data which were represented on logarithmic scales, the common logarithms of the individual values were used instead of the values themselves (7). This permitted a simpler calculation of

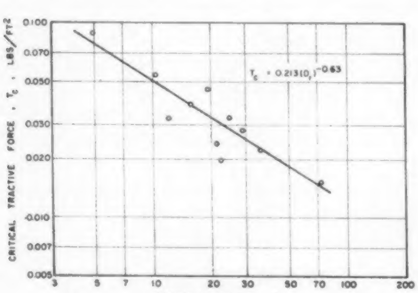



Fig. 5 *(Left)* Critical tractive force determined by Equation [2] or [8] versus the dispersion ratio

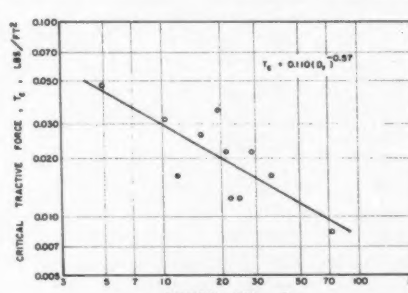



Fig. 6 *(Right)* Critical tractive force determined by Equation [9] versus the dispersion ratio

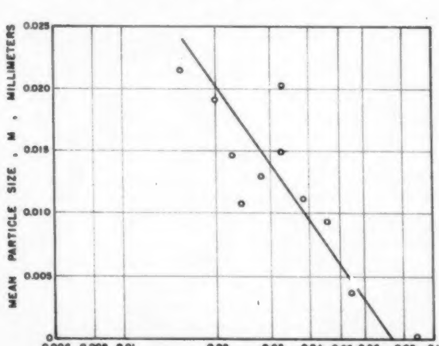



Fig. 7 *(Left)* Critical tractive force determined by Equation [2] or [8] versus the mean particle size

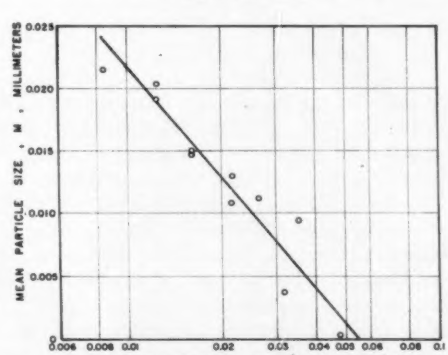



Fig. 8 *(Right)* Critical tractive force determined by Equation [9] versus the mean particle size

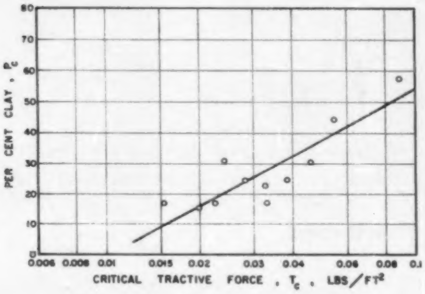
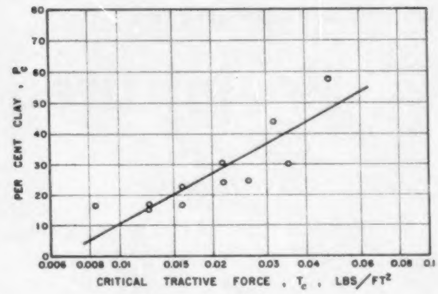



Fig. 9 *(Left)* Critical tractive force determined by Equation [2] or [8] versus the percent clay

Fig. 10 *(Right)* Critical tractive force determined by Equation [9] versus the percent clay




the regression equation. Furthermore, the standard deviations from regression were calculated using the deviation of critical tractive force from the regression of critical tractive force on the independent variable. The standard deviations from regression always refer to and are in terms of the common logarithms of the critical tractive force.

The data which were correlated are given in Figs. 3 through 10. A summarization of the statistical analyses including the regression equations is given in Table II. Table II is divided according to the method of evaluating the critical tractive force.

Although there is not much difference in the correlations, the relationships of the critical tractive force to the plasticity index or the dispersion ratio are considered more reliable than the others presented. This is because either the plasticity index or the dispersion ratio measures cohesion in a somewhat direct manner while the other soil properties deal only with the particle size distribution which is only an indirect index of cohesion. Also, the values of critical tractive force determined by Equation [2] or [8] are considered more reliable than those determined by Equation [9]. Two reasons are given for this. First, the measurements involved in using Equation [2] or [8] were more accurate than the velocity measurements used in Equation [9]. Secondly, the variables in Equations [2] and [8], channel slope, depth of flow, and rate of flow are quantities used by designers of open channels. Therefore, an analysis based on these same variables could more logically be used in field design.

#### Conclusions

The problem of the stability of open channels in cohesive soils can logically be approached on the basis of the tractive force theory. The effect of cohesion can be measured by physical tests of the soils and related to the critical tractive force.

The critical tractive force was determined by two independent methods. The results appear not to be the same, but a definite correlation exists between the values obtained by the two methods.

For the soils tested, the critical tractive force is well correlated with the plasticity index, the dispersion ratio, the mean particle size, and the percent clay.

The values of critical tractive force reported are for soils with voids ratios ranging from 1.23 to 1.84. Voids ratios of this magnitude correspond to a loosely compacted soil.

#### References


1 American Society for Testing Materials Committee D-18 Procedures for Testing Soils. Philadelphia, Pa.: American Society for Testing Materials, July, 1950.


TABLE 2. SUMMARY OF ANALYSES BY METHOD OF EVALUATION

| Variables | Correlation Coefficient, $r$ | Level of Significance of $r$ in per cent | Regression Equation | Standard Deviation from Regression, $S_r$ |
|---|---|---|---|---|
| $T_c$ determined by equation 2 or 8 | | | | |
| $\log_{10}(T_c)$ vs $\log_{10}(I_w)$ | 0.896 | 1 | $T_c = 0.0034(I_w)^{0.84}$ | 0.111 |
| $\log_{10}(T_c)$ vs $\log_{10}(D_r)$ | -0.892 | 1 | $T_c = 0.213(D_r)^{-0.63}$ | 0.103 |
| $\log_{10}(T_c)$ vs M | -0.860 | 1 | $T_c = 0.074 \times 10^{-28.1M}$ | 0.116 |
| $\log_{10}(T_c)$ vs $P_c$ | 0.980 | 1 | $T_c = 0.0103 \times 10^{0.0183P_c}$ | 0.046 |
| $T_c$ determined by equation 9 | | | | |
| $\log_{10}(T_c)$ vs $\log_{10}(I_w)$ | 0.849 | 1 | $T_c = 0.0022(I_w)^{0.82}$ | 0.131 |
| $\log_{10}(T_c)$ vs $\log_{10}(D_r)$ | -0.795 | 1 | $T_c = 0.110(D_r)^{-0.57}$ | 0.146 |
| $\log_{10}(T_c)$ vs M | -0.950 | 1 | $T_c = 0.055 \times 10^{-33.9M}$ | 0.079 |
| $\log_{10}(T_c)$ vs $P_c$ | 0.888 | 1 | $T_c = 0.00645 \times 10^{0.0182P_c}$ | 0.114 |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6 Smerdon, E. T. The tractive force theory applied to the stability of open channels in cohesive soils, Unpublished Ph.D. thesis, agricultural engineering dept., University of Missouri, August 1959.

7 Snedecor, George W. Statistical methods (Fourth edition). The Iowa State College Press, Ames, Ia., 1948.


## Transactions of the ASAE

AGAIN as in 1960 the TRANSACTIONS of the ASAE (Volume 4, 1961) will be published in two editions — one general and one special. The general edition will be published early in the year (February or March) and will contain at least 144 pages of technical articles. Articles will be selected from all divisions of ASAE. The second edition will be a special number which will contain at least 100 pages of material devoted exclusively to Power and Machinery subjects. Publication of the special edition will be in July or August.

Provision for ordering both editions has been made on ASAE membership dues invoices and AGRICULTURAL ENGINEERING subscription invoices. Since the number of pages per issue depends upon the number of orders received by February 1 for general edition and July 1 for special edition, purchasers of the Transactions are urged to order copies before deadlines. Copies of the general edition sell for $6.00 each ($3.25 to ASAE members); the special Power and Machinery edition $4.00 each ($3.00 to ASAE members). Combined price for both editions is $8.00 ($5.50 to ASAE members).

# Infrared Radiation Meter

***Cosine-corrected radiation meter used for high intensity infrared***

**J. G. Kemp, R. Bedford and A. E. Asselbergs**
Member ASAE

AN infrared radiation meter has been developed to interpret the results from studies involving infrared blanching and cooking of fruits and vegetables. Its purpose is to measure radiant flux being applied to produce. Infrared sources used have inputs of 50 to 100 watts per linear inch, and the maximum energy is radiated at a wavelength of 1 to 3 microns. The radiant flux densities to be measured are in the range 0.5 to 2.0 watts per square centimeter, and the surface temperature of the samples may be as high as 400 C. A wide-angle detector was required because of the large physical dimensions of the source. Since commercial infrared radiation meters for this type of application are not readily available it was necessary to design and construct the unit shown in Fig. 1.

As shown in Fig. 2, the sensing unit is basically a chromelalumel thermocouple. The hot junction is soldered to a 0.625-in. diameter hemispherical receiver which is formed from 0.002-in. brass shim stock and encased in a brass water-cooled jacket. A 0.25-in. diameter hole in the top copper cover plate serves as the aperture. The receiver is centered below this aperture so that its edge just clears the under surface of the cover plate. The hemispherical receiver and the immediate surrounding area of the water jacket and cover plate are coated with carbon black by an acetylene torch. The exterior of the unit is polished to increase its reflectivity. The thermocouple wires (number 22 B and S gage, 0.026-in. diameter), along with some asbestos shielding, support the receiver and supply the only contact to the main body of the unit. The cold junction of the thermocouple is soldered to the hollow steel stem which provides passage for the thermocouple leads through the water jacket. Cooling water is circulated through the radiometer at any desired rate. Tee connectors in the entrance and exit tubing provide a convenient place for inserting thermometers into the waterline to measure the cold junction temperature and to determine any rise in water temperature as it flows through the detector. In practice the water flow can be adjusted so that no appreciable temperature rise occurs. The output of the thermocouple is measured with a Rubicon portable precision potentiometer.

The receiver reacts much like a black body, therefore its response is not significantly affected by the characteristics of the blackening. It has a wide aperture, and in fact will respond to radiation from almost an entire hemisphere. Again, because it is essentially a black body, the detector will respond to radiation according to Lambert's cosine law; that is, its sensitivity will be fairly independent of the angle under which it views the source. Since the radiant flux densities to be measured are relatively high, the heat losses of the receiver have been made large so as to increase its speed of response. Adequate sensitivity is obtained from the use of only the single thermocouple junction.

The instrument was calibrated against a standard thermopile of the National Research Council of Canada over the range of flux densities for which it was to be used. The mean sensitivity of the unit was determined to be $0.95 \times 10^{-3}$ volts per watt per square centimeter for output voltages between 0 and $1.2 \times 10^{-3}$ volts. The use of this value for the sensitivity will give values of radiant flux density at the receiver to within $\pm 0.07$ watts per square centimeter.

*An Instrument News Contribution* from the Research Branch, Canada Department of Agriculture. Division of Applied Physics, National Research Council, Ottawa, Canada. Articles on agricultural applications of instruments and controls and related problems are invited by the ASAE Committee on Instrumentation and Controls, and should be submitted direct to Karl H. Norris, instrument news editor, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

The authors — J. G. KEMP and A. E. ASSELBERGS, respectively, are agricultural engineer and senior food technologist, research branch, Canada Department of Agriculture, Ottawa, Canada, and R. BEDFORD, physicist, National Research Council of Canada, Ottawa, Canada.

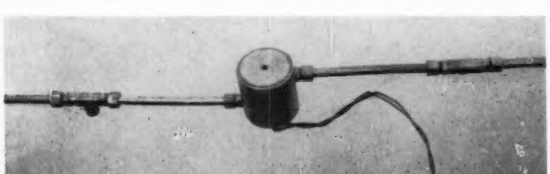

Fig. 1 *(Above)* Infrared radiation meter developed for food processing studies

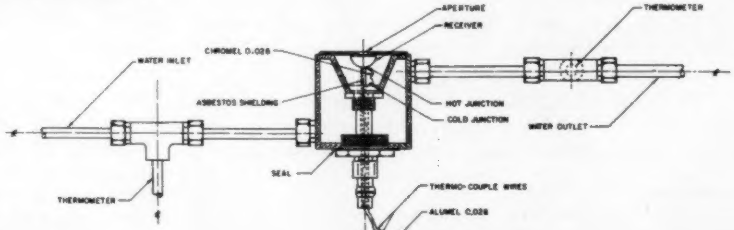


Fig. 2 *(Right)* Partial cross-sectional drawing shows hemispherical receiver and hot and cold junctions



S. C. Heth


A. R. Chamberlain


W. E. Eakin


T. E. Hienton


A. L. Neuhoff


H. A. Smith

**Sherman C. Heth** has been promoted to the position of vice-president of engineering for Jacobsen Manufacturing Co., Racine, Wis. He formerly was its manager of engineering. Before joining the company in 1958 he held the position of chief engineer in the advanced engineering department of International Harvester Co., Chicago, Ill.

**Adrian R. Chamberlain,** acting dean of the College of Engineering and chief of the civil engineering section, Colorado State University, recently has been named vice-president for administration. He received a B.S. degree in engineering at Michigan State University in 1951 and an M.S. degree at Washington State University in 1952. In 1955 he received the first Ph.D. degree ever awarded at CSU. After graduation he studied for one year under a Fulbright grant at the University de Grenoble in Grenoble, France. He joined the CSU staff in 1956 as research coordinator. He is also the CSU Research Foundation president and chairman of its board of trustees.

**W. Everett Eakin** has been promoted to press relations manager for Libbey-Owens-Ford Glass Co. He became associated with its public relations staff in 1946 and for more than a decade was in charge of market development for thermopane insulating glass in livestock and poultry buildings. Since January, 1960, he has been serving as assistant to the vice-president of public relations.

**T. E. Hienton,** chief, farm electrification section, AERD, ARS, USDA, attended the eighth session of the Working Party for the study of rural electrification at the Palais des Nations, Geneva, Switzerland, October 1-3. He acted as advisor to the American delegate, Jarvis Davenport. The Working Party on Rural Electrification is a subcommittee of the Committee on Electric Power, United Nations Economic Commission for Europe. He also participated in a three-week study tour of rural electrification in the United Kingdom and Ireland, provided for the Rural Electrification Working Party, September 12-30. Details were arranged by the Ministry of Power and the Electricity Council of the United Kingdom and the Electricity Supply Board of Ireland.

**Alfred L. Neuhoff** has been transferred to the Burlington Works of the J. I. Case Co. as assistant chief product engineer. He started with the company in 1955 at the Rockford Works, serving there in various engineering capacities — most recently, in charge of the quality control department.

**Harry A. Smith,** who has been with the Calcium Chloride Institute for the past seven years as field engineer in the north central states area, has been promoted to the newly created position of senior regional engineer. In addition to the duties of his new position he will also plan national programs in the highway industry.

**James H. Turner** is now an assistant professor and engineering illustrator for publishing engineering educational materials at the University of Georgia.

## THREE ANNOUNCE RETIREMENT


E. D. Merrill

☆


C. C. Ricker

☆


A. E. Becker

**Earl D. Merrill,** educator-agriculturist-steelman, retired December 15 as director of the Agricultural Extension Bureau of Republic Steel Corp. Since joining the company in 1949, he has worked with the Agricultural Extension Service, agricultural experiment stations, 4-H and Future Farmers of America Clubs, as well as a variety of other farm organizations. His efforts have been aimed at helping the farmer with his problems while at the same time promoting modern farming through greater use of steel on the farm.

Born in Lamartine, Wis., he received his early education in Manassas, Va., and later attended the University of Virginia. After serving in World War I, he was graduated from Cornell University in 1921, earning a B.S. degree in agriculture. Shortly after, he was named principal of Greenwich High School in Nokesville, Va. For eight years he held the position of county agricultural agent in Monroe County, N. Y. From 1930 until he joined Republic Steel in 1949, he was manager of Forest Farms, a 500-acre combination dairy, turkey, potato and apple farm in Webster, N. Y.

In addition to working closely with agricultural groups, Mr. Merrill authored a column entitled "Over the Farm Fence" for the company's monthly agricultural publication, *The Farm Spokesman*. He has been an ASAE member since 1949 and is also a member of the Farm Conference of the National Safety Council and the National Association of Manufacturers' Policy Committee on the conservation and management of natural resources.

**C. C. Ricker** has announced his retirement as area engineer for the USDA Soil Conservation Service at Greencastle, Ind. After 21 years of varied experiences, including railway engineering, highway bridge contracting, private professional engineering service and engineering appraisal service, he accepted a position of engineer in the Soil Conservation Service at its beginning in 1935. Due to the initial lack of established standards, this work for several years was necessarily of a pioneering nature requiring the application of study and research methods to develop the best designs of engineering structures and mechanical practices adapted to the solution of soil and water conservation problems. Mr. Ricker had a part in the development of the high technical standards adopted by the Service during its quarter-century growth. He is a 1914 graduate of Purdue University, having received a B.S. degree in civil engineering. He has been an ASAE member since 1936, is a fellow of the American Society of Civil Engineering, a member of the Soil Conservation Society of America and Tau Beta Pi. He is a licensed professional engineer and is listed in "Who's Who in Engineering."

**Abram E. Becker,** manager of the Association of Illinois Electric Cooperatives, Springfield, Ill., for the past 17 years, has recently retired. A lifelong resident of Central Illinois, he was a leader in the development of rural electrification in Illinois and the nation. He helped to organize and then served as manager of the Menard Electric Cooperative of Petersburg, prior to his employment with the state association, which he also helped to establish. He also inaugurated a job training and safety program for line personnel of the electric co-ops in Illinois. He has been an ASAE member since 1955, was a charter member and president of the Illinois Farm Electrification Council. He also served as a board member of the Inter-Industry Farm Electric Utilization Council, composed of rural electric co-ops, private power utilities, and manufacturers.

Henry Loeb, mayor of Memphis, acknowledges applause following his welcome to ASAE members during Tuesday afternoon General Session

ASAE President L. W. Hurlbut *(left)* chats with A. B. Kinzel, president of Engineers Joint Council, who spoke on EJC and its relationship to ASAE during the General Session

Wheeler McMillen, vice-president, Farm Journal, addressed the General Session on the subject of public relations in agriculture

# WINTER MEETING HELD IN MEMPHIS

## December 5 to 7, 1960

From many reports the change in the location of the 1960 Winter Meeting from Chicago to Memphis, Tenn., to encourage attendance from the fast-developing agricultural areas of the southern part of the United States, was highly successful. Letters received subsequently by ASAE headquarters from members throughout the country have been highly complimentary of facilities and excellent planning for the three-day meeting held December 5 to 7 at the Peabody and Chisca Hotels. Members of the Tennessee, Southeast, and Southwest Sections combined their efforts to make the meeting a success. J. K. "Farmer" Jones served as co-ordinator, and H. D. Sullivan was general chairman and treasurer. Other members of the committee were as follows: T. O. Walker, public relations chaiman; J. N. Meroney, registration chairman; L. C. Evans, assistant registration chairman; R. P. Kay, information and service chairman; W. J. Liddell, paper distribution and booster comittee chairman; J. A. Mullins, assistant paper distribution chairman; A. M. Leggett, special exhibits chairman; J. H. Anderson, concurrent sessions service chairman; and G. T. Hardy, shuttle bus chairman. Registration totaled 1191 and has been exceeded only twice before at Winter Meetings in Chicago in 1958 and 1959.

The new meeting location also appealed to the ladies, resulting in an attendance of more than 60. A most interesting ladies' program, under the supervision of Mrs. H. D. Sullivan, included a welcome coffee, luncheon and fashion show, tour of Memphis, and a tour of ante bellum homes at Holly Springs, Miss. Mrs. J. K. Jones was in charge of the hostesses at the hotels.

### Council and Cabinet Sessions

The ASAE Council met Saturday and Sunday, December 3 and 4, preceding the regular meeting and various times during the meeting to dispose of a variety of administrative matters. A summary report of Council action will appear in the February issue. The Cabinet meeting, held Sunday evening, officially opened the three-day meeting, with opening remarks by President L. W. Hurlbut. ASAE Section reports were confined to outstanding activities conducted by the sections and how each section is following through on promotion of the recently released ASAE motion picture, "Agricultural Engineering—The Profession With a Future." President Hurlbut concluded the session with an account of the Society's progress during the past few years and pointed out some of the increased responsibilities that will be faced as the organization continues to increase in size.

### Public Relations

Public relations and publicity for the meeting were handled by Emmett Robinson and Ed White of Delta, Inc., a professional organization, with assistance from a local public relations committee consisting of T. O. Walker (chairman), James Ewing, Fred Berggren, and John and Helen Wessman. A brief summary of some of the activities conducted by this group include: Preparation and mailing of advance news releases to radio farm directors, farm editors of newspapers, college engineering magazines, extension editors, and miscellaneous publications for a total of over 900 outlets; preparation and mailing of 78 home-town releases on program speakers; and preparation and mailing of over 300 personalized invitations to press people, with provision for ordering press kits and tapes. A total of 31 stories were prepared for press kits, including 29 paper digests, and over 30 program speakers were contacted for visuals for use in conjunction with television appearances. Arrangements were made for 16 local radio and television shows. In addition 23 radio interview tapes were prepared, under the sponsorship of International Harvester Co., arranged by T. E. Clague.

*(Above Left)* G. W. Giles *(left)* chairman of agricultural engineering, North Carolina State College, was the featured speaker at the 15th annual FEI "dinner for professors." His subject was "Goals of Agricultural Engineering Research." He is shown with Frank P. Hanson, who has served for many years as master of ceremonies of the event prior to his retirement last year

*(Above right)* Jack Timmons *(left)*, commercial manager of radio station KWKH, Shreveport, La., featured speaker during Farm Structures Milker, is shown sharing dairy refreshments with Mrs. Marianne Hocker, home economist, Memphis Dairy Council, and L. E. Bradley, Milker chairman

*(Far Right)* ASAE sessions met with some competition when a hair dressers' convention was held concurrently one evening in the Hotel Peabody. One young lady, sporting an "out-of-this-world" creation, graciously posed for the ASAE camera

*(Above)* **A long question and answer period followed the presentation of a paper on developing and engineering of a field wafer machine, by V. J. Lundell and D. O. Hull, co-authors, during the Monday afternoon Power and Machinery program on forage harvesting. Examining the wafers are** ***(left to right):*** **L. H. Skromme, chief engineer, New Holland Machine Co., V. J. Lundell, president, Lundell Manufacturing Co., D. O. Hull, professor, agricultural engineering department, Iowa State University, D. P. Storm, test engineer, International Harvester Co., and T. E. Clague, copywriter, Aubrey, Finlay, Marley & Hodgson, Inc.** ***(Right)*** **The success of a meeting such as the Winter Meeting depends in great part on the hard work of the local arrangements group. Only six of the men responsible for the excellent manner in which the Memphis meeting was conducted were available for the camera. Standing** ***(left to right)*** **T. O. Walker, public relations chairman; J. H. Anderson, concurrent sessions service chairman; and J. A. Mullins, assistant paper distribution chairman. Seated** ***(left to right)*** **H. D. Sullivan, general chairman and treasurer; J. N. Meroney, registration chairman; and J. K. Jones, coordinator**

### Technical Sessions

The technical sessions opened on Monday morning, December 5, with the Power and Machinery Programs "A" on chemical application—session I and Program "B" on tractors—session I; Soil and Water on irrigation; Farm Structures on farm building construction; and Electric Power and Processing on automation in agriculture. The five concurrent sessions scheduled for Monday afternoon included: Electric Power and Processing on developments in materials handling; Power and Machinery—Program "A" on forage harvesting and Program "B" on cotton processing; Soil and Water on hydrology; and Farm Structures on building design.

The subjects presented on the five concurrent sessions set up for Tuesday morning included: Farm Structures, farm housing; Electric Power and Processing, farm wiring developments and needs; Power and Machinery—Program "A", chemical application—session II and Program "B," crop culture; and Soil and Water, soil erosion.

The Wednesday morning concurrent sessions consisted of: Soil and Water—Program "A," drainage design and Program "B," drainage research; Farm Structures, environment in livestock buildings and its control; Electric Power and Processing, radiation in agriculture; Power and Machinery — Program "A," testing and analysis and Program "B," general. The five sessions scheduled for Wednesday afternoon covered: Power and Machinery—Program "A," harvesting and Program "B," tractors — session II; Soil and Water, irrigation; Farm Structures, poultry housing; and joint Farm Structures and Electric Power and Processing, solar energy in agriculture. Copies of papers presented may be obtained from ASAE Headquarters at 50 cents each.

### General Session

During the general session on Tuesday afternoon, December 6, the Continental Ballroom of the Peabody Hotel was filled to capacity to hear A. B. Kinzel, president of Engineers Joint Council, speak on EJC and its relationship to ASAE and Wheeler McMillen, vice-president of *Farm Journal*, speak about public relations in agriculture. His Honor Henry Loeb, mayor of Memphis was on hand to welcome the Society to Memphis.

### Special Events

For the second straight year a session on the 4-H Electric Program was held Tuesday afternoon following the general session. H. S. Pringle, extension agricultural engineer, Extension Service, USDA, and John Hallenberg, assistant manager, Power Use Dept., Westinghouse Electric Corp., led a most stimulating discussion. The Farm Structures Milker was rescheduled again this year after an absence of one year. Jack Timmons, commercial manager, KWKH, Shreveport, La., was the featured speaker, whose topic was agriculture's weakest link.

### FEI Dinner

The 15th annual "dinner for professors," sponsored by the Farm Equipment Institute, held Tuesday evening, December 6, was attended by 500 representatives from land-grant colleges, the U.S. Department of Agriculture and the farm equipment industry. G. W. Giles, chairman of agricultural engineering, North Carolina State College, addressed the meeting on the subject "Goals of Agricultural Engineering Research." A special feature was the showing of the new FEI film, "The Earth is the Lord's." A new brochure, "Our Future is Linked Together," was distributed to those in attendance. Two long-time ASAE members were honored during the dinner meeting for outstanding contributions in the field of agricultural engineering. The FEI Merit Award was presented to Howard Ingerson, recently retired agricultural sales manager of the John Bean Division of the Food Machinery and Chemical Corp. Merlin Hansen, chief engineer, John Deere Research and Engineering Center, and vice-chairman of the Technical Committee of Power and Machinery Division of ASAE, received the Advisory Engineering Merit Award. Presentations were made H. L. Byrd, president of FEI and vice-president of the Food Machinery and Chemical Corp.

*(Continued on page 42)*


**A luncheon was held in honor of the 50th anniversary of agricultural engineering at the University of Nebraska for graduates, former students, staff and former staff members. Shown above are some of those who attended. Many others left before picture was taken**


### Georgia Section

The Georgia Section, ASAE's oldest state section, celebrated its 25th anniversary during 1960. Under the leadership of Section Chairman R. H. Brown this milestone was actually observed twice — during a two-day fall meeting on the University of Georgia campus November 10 and 11, and with a special breakfast during the Winter Meeting in Memphis.

Speaking at the fall Section meeting National President Lloyd W. Hurlbut declared that understanding, effective communications and active career counseling are needed to lead high school students to pursue agricultural engineering studies in college. Other out-of-state visitors, who joined the Georgians for their Silver Anniversary fall meeting, included F. B. Lanham, head, agricultural engineering department, University of Illinois; E. G. McKibben, director, USDA Agricultural Engineering Research Division; and W. J. Ridout, general manager, Electricity-on-the-Farm Magazine. One of the banquet highlights was an address by R. H. Driftmier, chairman, agricultural engineering division, University of Georgia, and one of the founders of the Section. He recalled the events that led to formation of the Section and cited some of the outstanding events in its history. Another speaker, C. C. Murray, dean and coordinator of the College of Agriculture, revealed that a new, modern building to house the agricultural engineering division is a part of the College's long-range planning.

### Quad City Section Donates Books

The Quad City Section has presented to the Moline (Ill.) Public Library several technical books particularly useful to agricultural engineers and other agriculturalists, which include the following: Engineering for Agricultural Drainage, by Roe and Ayres; Fundamentals of Soil Science, by Millar; An Introduction to Agricultural Engineering, by McColly and Martin; Irrigation Principles and Practice, by Israelsen; Electricity in Agricultural Engineering, by Hienton, Wiant and Brown; Agricultural Process Engineering, by Henderson and Perry; Soil and Water Conservation Engineering, by Frevert, Schwab, Edminster and Barnes; Diseases of Field Crops, by Dickson; Commercial Fertilizers, by Collings; Farm Electrification, by Brown; Textbook of Wood Technology, by Brown; Farm Structures, by Barre and Sammet; Tractors and Their Power Units, by Barger, Carleton, McKibben and Bainer; and Principles of Farm Machinery, by Bainer, Kepner and Barger. Moline Public Library was chosen as the recipient because of its central location in the area. The Section expects to add to the collection from time to time to keep it up to date.

A Section dinner meeting will be held on January 13 at the American Legion Hall, Moline, Ill. Featured on the program, will be L. S. Kellogg, economist, Deere & Co., Moline, Ill., who will speak on "Nostalgia, Agriculture and Agricultural Engineering," and W. M. Cade, divisional chief engineer, test and development group, Farm Equipment Research and Engineering Center, International Harvester Co., Hinsdale, Ill., whose topic will be "Creating Time Through Test Engineering."

### Pennsylvania Section

The Pennsylvania Section held its fall meeting on November 4 and 5 at the Hetzel Union Building, Pennsylvania State University. The program following the luncheon on November 4 included the presentation of papers on patents and engineering, new shapes in concrete, development of equipment for the application of agricultural chemicals, and a panel discussion on land and water resource development for recreation and wildlife. During the business meeting the following officers were elected for the year 1961: William L. Kjelgaard, chairman; Robert S. Crist, vice-chairman; Earl A. Myers, secretary-treasurer; and nominating committee, Charles B. Adams (chairman), Nevin T. Brenner, and Morris E. Schroeder. At the Friday evening banquet, held at Eutaw House, Potters Mills, John Washko, professor of agronomy, Pennsylvania State University, and president, American Grassland Council, addressed the group on European grassland farming.

*(Continued on page 40)*

## ASAE MEETINGS CALENDAR

January 20—Southern California Chapter, Pacific Coast Section, Rodger Young Auditorium, Los Angeles, Calif.

January 25 — Connecticut Valley Section, Carville's Motor Court and Restaurant, Hartford Springfield Expressway, Hartford, Conn.

January 26 — Minnesota Section, Buroch's Cafe, Hopkins, Minn.

February 6-8 — Southeast Section, Robert E. Lee Hotel, Jackson, Miss.

February 25—Michigan Section, Hudson's Northland, Detroit, Mich.

March 30-31 — Pacific Coast Section, Davis, Calif., area.

**April 7-8 — Mid-Central Section, St. Joseph, Mo.**

April 14-15 — Rocky Mountain Section, University of Wyoming, Laramie.

**April 14-15 — Southwest Section, Grim Hotel, Texarkana, Texas.**

**June 25-28—Annual Meeting, Iowa State University, Ames, Ia.**

**August 20-23—North Atlantic Section, University of New Brunswick, Fredericton, N. B., Canada.**

December 13-15 — Winter Meeting, Palmer House, Chicago, Ill.

**Note: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.**

## OLDEST STATE SECTION CELEBRATES 25TH ANNIVERSARY

**The Georgia Section, ASAE's oldest state section, celebrated its Silver Anniversary at its fall meeting in November. As indicated by photo above, attendance was good. *(Left)* Taking major rolls in the celebration were left to right: R. H. Brown, Section chairman; E. G. McKibben, past-president of ASAE and director, Agricultural Engineering Research Division, ARS, USDA; R. H. Driftmier, past-president of ASAE and chairman, division of agricultural engineering, University of Georgia; Lloyd W. Hurlbut, president of ASAE and chairman, agricultural engineering department, University of Nebraska; F. B. Lanham, head, agricultural engineering department, University of Illinois; and W. J. Ridout, general manager and editorial director, Electricity-on-the-Farm Magazine**

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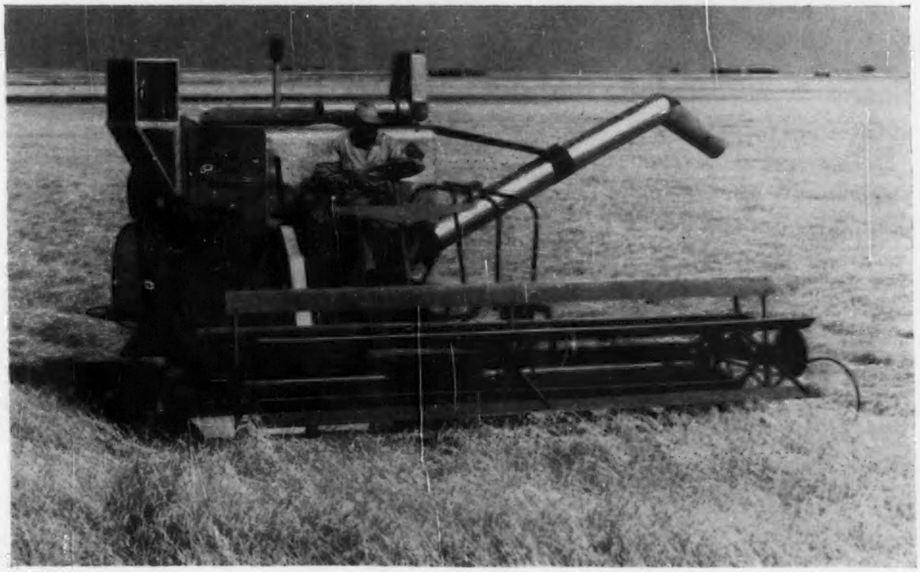

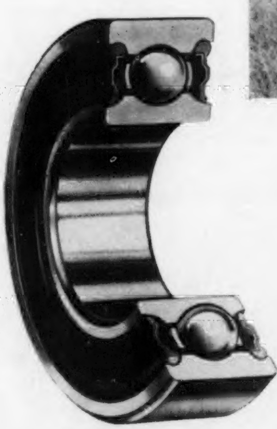

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### 1961 A-C Tractors Sport New Color Scheme

Allis-Chalmers Manufacturing Co., Tractor Group, Milwaukee 1, Wis., has introduced three new tractors and a new yellow

color design in its 1961 line of utility tractors and matched utility equipment. The new tractors are the D-15 utility wheel tractor and the H-3 and HD-3 utility crawler tractors, designed with a wide range of matching equipment for construction, industrial, materials handling and maintenance applications.

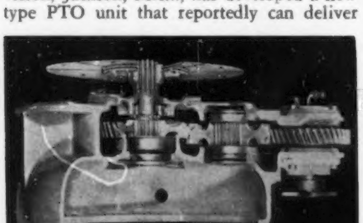
Manufacturer's rating of the D-15 is 48 hp. It features a heavy duty, non-adjustable front axle and 24-in. rear wheels. The H-3, powered by a 43-hp (manufacturer's rating) gasoline engine, and the HD-3, featuring a 40-hp (manufacturer's rating) diesel engine, are both in the 6,000-lb weight classification.

Also introduced were newly designed versions of the firm's D-10, D-12 and D-17 utility wheel tractors. The D-15 and H-3 and HD-3 tractors feature the company's shuttle clutch which is designed to provide intermediate precision lever control of the tractor's power and speed, forward or reverse, without foot clutching or gear shifting.

The new yellow utility tractor line color design is a departure from the traditional Allis-Chalmers Persian orange. On the wheel tractors with the line, the yellow is matched with a wheat color trim on the wheels.

### Adds New Type PTO

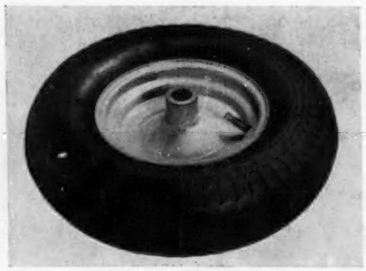
Clark Equipment Co., Automotive Division, Jackson, Mich., has developed a new type PTO unit that reportedly can deliver



70 hp without requiring changes in other power train components. The new design bolts to the engine flywheel housing, thus is ahead and independent of the clutch and transmission. Primary applications are vehicles such as transit concrete mixers, fire trucks, fuel trucks and farm equipment where large amounts of engine power are required to drive accessories, it is said. The unit is readily adapted to any gasoline or diesel engine with either SAE No. 2 or SAE No. 3 bell housings. Two speed ratios (1.27-to-1 and 1-to-1) are available in standard production models. Power is transmitted from the engine to the vehicle clutch and transmission by a shaft running the length of the PTO unit and through a gear train to the PTO output shaft.

### Re-enters Small Wheel Field

French and Hecht Division of the Kelsey-Hayes Co., Davenport, Ia., has announced a wide range of small-diameter,



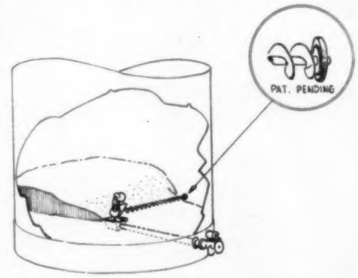
pneumatic-tired wheels for industrial and agricultural applications.

The new wheels are designed for low-speed, light-duty operations in various hub and bearing combinations ranging in diameter from ⅝ in., to hub lengths up to 7½ in. using 8-in. pneumatic tires.

Formerly the company offered foundry cast wheels in this size range. The current offerings mark a re-entry into the field with stamped drop-center rims and the hub welded into one assembly.

### Automatic Bin Unloader

American Planter Co., Burr Oak, Mich., has developed an automatic unloading device that sweeps all material to a sunken hopper




where gravity leaves off. In operation a floating "gathering screw" powers into the material by its own rotation, pivoting around the center sump without gears or other mechanism. It governs its own rate of entry into the material without supervision. It can even be wired to turn itself off when the bin is completely empty.

### Adds New Spreader

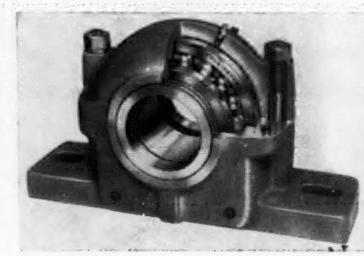
New Holland Machine Co., New Holland, Pa., has added a high-capacity model to its line of spreaders. The new entry is

the Model 475, with an ASAE-rated capacity of 175 bu. The big spreader, it is said, is built especially to reduce the number of trips and cut spreading costs on large livestock farms, where manure output is measured in tons. It also is designed to make fertilizing of distant fields more economical on farms of any size.

To reduce spreader breakdowns, the apron chains are double strength, and are protected by a shear bolt. The bolt shears under abnormal loads so the operator can eliminate the trouble without having to remove a heavy load by hand to repair broken chains.

### Spherical Roller Bearing Pillow Blocks

The Torrington Co., Bantam Bearings Div., South Bend 21, Ind., has introduced two new series of heavy duty pillow blocks,



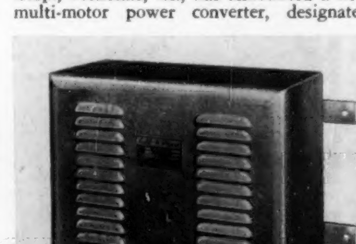
with self-aligning spherical roller bearings in split housings. The new pillow blocks are now available in 143 sizes and are suited for a wide variety of applications.

Series SAF has two bolts clamping cap to base, and Series SDAF, with heavier castings, has four cap bolts. All sizes are available with straight bore bearings for shouldered shaft mounting, or with adapter bearings suitable for mounting on straight commercial shafting.

Housing seats are machined to bearing widths plus ⅜ in. This permits each pillow block to be used as a floating unit or, with standard ⅜ in. wide stabilizing ring in place, as a fixed pillow block.

### Multi-motor Power Converter

Add-A-Phase, Division System Analyzer Corp., Nokomis, Ill., has announced a new multi-motor power converter, designated



type MM, to permit the operation of 3-phase electrical equipment from single-phase lines, with the additional feature of opening operation to any number of 3-phase motors through a single conversion system. According to the manufacturer, 3-phase motors can be operated singly or simultaneously and that multi-motor units will produce full rated horsepower for all motors connected. Transformer stations are available in sizes from 1 to 80 hp. The unit reportedly will operate 220 or 440-volt 3-phase equipment from 220-volt single-phase lines.

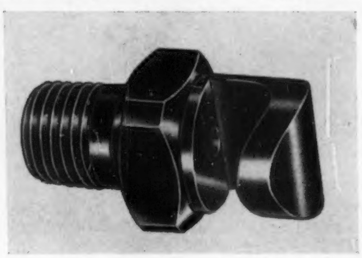
### Pole Type Building Has 36-ft Clear Span

Inland Steel Products Co., P.O. Box 393, Milwaukee 1, Wis., has introduced a new, all-steel, pole-type building with a 36-ft clear span. Like an earlier, 24-ft wide version, the new building is made up of several "modules," or standard units, which can be

combined in a choice of sizes, shapes and layouts. The basic standard unit is 24 or 36-ft clear-span center section. It has ranch-type, low gable and is available in eave heights from 8 to 14 ft. Used alone, it provides column-free space 24 or 36 ft wide by any length in multiples of 12, 16 or 20 ft. Standard lean-to units 12 and 18 ft wide are also available.

### New Nylon Nozzle for Fertilizer Application

Delaven Manufacturing Co., West Des Moines, Iowa, has announced a new nylon nozzle designed primarily for the application



of balanced fertilizers. The new development is a deflector type nozzle and delivers a fan spray. It is available in sizes ranging from 5 to 100 gpa. For complete details, write to the company for catalog 2-1-9.

### Eight Rows and Four Operations—Simultaneously

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., has introduced both a duplex planter hitch which

permits hookup of two 4-row planters together and a front-mounted cultivator that works eight rows at a time.

Two chain-driven 4-row planter units can plant, fertilize and supply weed and insect control chemicals cutting working time to as much as one-eighth the time required previously. Accuracy of seed planting reportedly is maintained since planter units are individually hinged to the main frame allowing each unit to conform to surface irregularities independent of other units.

Liquid fertilizers also can be used in this combination. Planter-mounted or tractor-mounted tanks are equipped with a system which meters at 12 different rates from 45 to 890 lb per acre. A front-mounted tank can be used in the same manner for liquid chemical for weed and insect control.

### New Liquid Applicator Simplifies Seed Treatment

Morton Chemical Company, 110 N. Wacker Dr., Chicago, Ill., has developed a device for treating seed while it is being moved from bin to bin, or from bin to wagon. The new chemical applicator used in conjunction with an auger elevator consists of a 1-in. plastic bottle cap equipped with a length of small hose and an automatic air intake control. When attached to a bottle of liquid seed treatment, this simple device meters the liquid at the desired amount per bushel. Rate of application is increased or decreased by raising or lowering the open end of the applicator hose.

The liquid disinfectant is applied as the seed enters the elevator and is mixed during the augering process. There is no need for a special mixer or shoveling the grain from one pile to another in the treating process.

### New Tractor Tire Synthetic Rubber Compound

The Firestone Tire and Rubber Company, 1200 Firestone Parkway, Akron 17, Ohio, has developed a new synthetic rubber compound for making rear tractor tires. The new tread rubber is said to be the result

*(Continued on page 38)*

## . . . New Products

*(Continued from page 37)*

of the development of a new polymer and the application of advanced compounding techniques. Improved types of anti-oxidants in the new compound reportedly provide additional weathering resistance to aging and cracking.

Company tests involving experimental tractor tires that were built with one-half the regular tire compound and one-half the new compound, and exposed to accelerated weathering tests on ozone drums, indicated that an average of 56 percent longer tread wear resulted from tires built with this new compound.

### Flail-type Manure Spreader

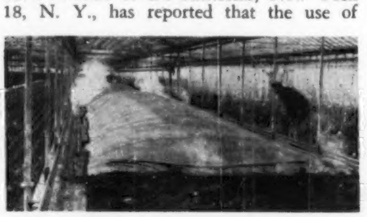
New Idea Farm Equipment Co., Coldwater, Ohio, has announced a new 130-bu flail-type manure spreader. The new ma-

chine features a single undershot cylinder, which carries 16 free swinging, weighted, heat-treated, sharpened flails. The flails reportedly shred and spread manure in any kind of weather. Hard, frozen chunks are said to be no problem for the new spreader. A heavy steel hood over the spreading mechanism keeps manure flying low so that cross winds cannot carry it.

Power is transmitted to the flail cylinder through a bevel gear box and roller chain drive. The drive is readily adaptable to tractors having 1,000-rpm PTO drives. A spring-type slip clutch protects the drive line.

### Coating Process Extends Life of Sterilization Covers

Vulcan Division, Reeves Brothers, Inc., 1071 Avenue of the Americas, New York 18, N. Y., has reported that the use of



hypalon-covered nylon fabric has cut the cost of greenhouse soil fumigation by extending the useful life of sterilizing covers. In one installation soil is fumigated by laying a 110 by 16-ft sterilizing cloth over the bed and weighing it down with 4 by 4-in. lumber at the edges which rest on 18-in. concrete walks between beds.

Steam is then introduced under the cover through lines of tile beneath the soil surface, ballooning it to a height of about 3 ft. The steam is forced in for about 10 hr to fumigate the soil thoroughly, and then the cover is moved to a new position.

Until the new coating process was developed covers could be used only one season before becoming brittle and starting to crack and peel. The new covers reportedly have about 30 percent higher initial cost than previously used covers, however they are expected to provide at least twice as much wear and service.

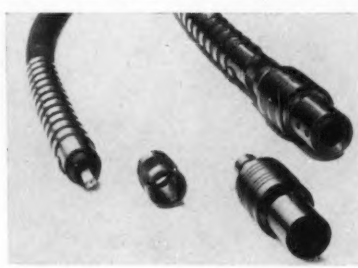
### New Crawler Tractor

J. I. Case Co., Racine, Wis., has announced a new 750 crawler tractor featuring a 301-cu in. diesel engine. The new

model is equipped with the company's "Terromatic" transmission and a "load-sensing" torque converter that reportedly produces up to 23,000 lb push-pull effort. Speeds range from 0 to 6 mph forward and 0 to 6.6 reverse. Power shifting, power steering and independent power control of each track are also featured. Other features include finger-tip-pressure hydraulic controls and self-lubricating lower track rollers. Lift capacity is reported at 16,000 lb.

### Quick-Disconnect Flexible Shaft

Stow Mfg. Co., 39 Shear St., Binghamton, N. Y., has developed a new power drive flexible shaft with a built-in quick-discon-

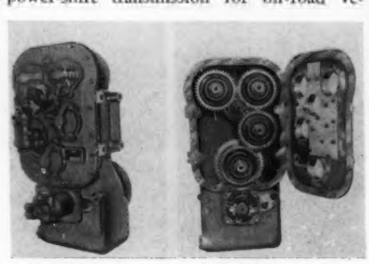


nect coupling for applications requiring a portable source of power that can be connected and disconnected quickly. By use of a spring-ball method the shaft can be connected or disconnected at either the power source or drive component.

The shaft is available in three sizes: ⅜, ½, or ⅝-in. core, having a maximum torque capacity of 220 in.-lb.

### New Power-Shift Transmission

Clark Equipment Co., Automotive Division, Jackson, Mich., has develouped a new power-shift transmission for off-road ve-

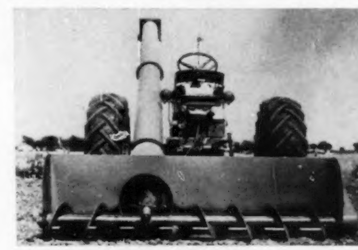


hicles. Designated the 2000 series, the new unit is designed for use with the company's 270 series torque converter. It will be used with gasoline or diesel engines of approximately 200 lb-ft of torque output. A system of four hydraulic clutches provides two speeds forward and two reverse, fully power shifted. A manual range selector is used, providing for four speeds in each direction. Reduction ratios are 4.78 and 2.53 in the two lower gears and 1.31 and 0.69 in the higher gears.

The transmission is lubricated by the torque converter oil and serves as the sump for the converter. Hydraulic power to operate the clutches is supplied by a pump mounted on the torque converter. The unit is adaptable for either 2 or 4-wheel drive with output shaft 17 in. below the input shaft. The engine may be located in the front or rear of the vehicle. Front or rear-wheel disconnect for operation in 2 or 4-wheel drive is an optional feature. Parking brake and automatic clutch release also are available.

### Mobile Loader for Ground or Flat-Stored Grain

Industrial Machinery Co., Inc., 2400 South Main St., Fort Worth, Tex., has introduced a new high-capacity mobile loader



for loading ground or flat-stored grain. The new loader incorporates standard screw conveyors into a fully automatic, one-step loading apparatus which can be mounted on a tractor with a 3-point hitch. A 14-in. horizontal screw conveyor which spans the loader's rear-mounted scoop serves as a gathering device to feed extended loading conveyor which protrudes from flared end of 24-ft-long inclined loading tube. The rear-mounted scoop is adjustable at two points to prevent damage to either the loader or the surface from which material is being picked up.

### High-Speed Pitmanless Mower

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., has introduced a new high-speed, side-mounted pit-

manless mower designed for both industrial and agricultural work. The new No. 110 mower is designed for such diversified operations as cutting hay, mowing highway shoulders and right-of-way, as well as for maintaining parks and industrial areas. The mower's cutter bar and what is described as wrist-action drive operate as a unit thereby resulting in constant sickle register. The counter-balanced knife drive reportedly permits high operating speed with low vibration.

Safety features include V-belt drive, which, in most instances, will absorb the initial shock of stones or sticks entering between knives and guards; slip clutch which gives protection under such severe conditions as found in highway mowing; and when an operator hooks a stump or post, the cutter bar breaks away and swings 45 deg to the rear easing the blow. As the cutter bar swings to the rear the V-belt loosens automatically to stop sickle drive and prevent damage. The cutter bar automatically swings back into cutting position when the tractor is moved in reverse.

### Pillow Block Unit for Moderate Loads

The Fafnir Bearing Co., 37 Booth St., New Britain, Conn., has developed a new pillow block unit which incorporates sturdy

pressed-steel housings designed for precision bearing-to-housing fit and a true self-aligning bearing. Known as the PBS, this new unit accommodates shaft sizes between ½ and 1⁷⁄₁₆ in. It is suitable for pillow block bearing applications where moderate speeds, moderate radial loads, and relatively light thrust loads are encountered, as in fans, idler shafts, conveyors, pump shafts, and other lightly loaded power shafts.

### Vibration and Shock Safety Switch

Frank W. Murphy, Mfr., Inc., 3131 South Sheridan Road, Tulsa, Okla., announces a new safety switch designed to shut down equipment subject to destructive vibration or shock. Sensitivity is easy to adjust with a screw driver while equipment is in operation. The new switch is designed to be sensitive to abnormal oscillation in two planes of motion for use on engines, pumps, oilwell pumping units, compressors or any other equipment where vibration or shock could result in destruction of equipment. It can be wired to ground ignition, sound alarm, activate control panel lights, or operate valves such as fuel shut-off valves or electric motor controller circuits.

### Analyzer for Flowing Effluent

LKB Instruments, Inc., 4840 Rugby Ave., Washington 14, D. C., announces a new system of automatic analysis of flowing effluent from chromatography and electrophoresis columns. A design allowing interconnection of three instruments (ultraviolet absorptiometer, recorder, and fraction collector) makes this possible.

The absorption of effluent is detected at 2537 angstroms and the curve recorded on the recorder. A special event marker built into the recorder allows each test tube of the fraction collector to be automatically indicated on the chart. Correlation between test tubes containing relevant sample and the indicating chart recording is practically immediate. Spectrophotometric analysis is then composed only of reading a few test tubes.

**W. T. Burtschi** ***(left)*****, new chairman of the Oklahoma Section poses with B. M. Kay, retiring chairman, during fall Section meeting on October 28**

***(Below)*** **Of particular interest during the Central Illinois Section meeting, held Nov. 28, was the attendance of visitors from foreign countries.** ***(Left to right)*** **Melvin Gehlbach (speaker); B. P. Ghildyal; Solomi Modi, graduate student, India; K. E. Fuller, Section chairman; T. K. Subramanyam; A. J. Muehling, Section secretary-treasurer; M. K. Moolani; and Alexander Bartosik. Drs. Subramanyam, Moolani, and Ghildyal are agronomists in the agricultural engineering department at the Indian Institute of Technology at Kharagpur, India. Dr. Bartosik is vice-dean of the College of Farm Mechanization, Polytechnical School at Poznam, Poland.** ***(Right)*** **Melvin Gehlbach, fieldman, Farm Bureau Farm Management Service, spoke on the real agricultural problem today. Is there a solution?**

## ... With ASAE Sections

*(Continued from page 34)*

Papers were presented on random bale handling and drying, animal actuated silage feeder, and egg packaging and handling during the final session held Saturday morning.

### Oklahoma Section

The Oklahoma Section met on October 28 on the Oklahoma State University campus for its annual fall meeting. The program included the presentation of papers entitled "Structural Requirements for Electric Heating," by Fred E. McVey, assistant chief of electric operations and loans division, REA, and "Agriculture, the Biggest Single Industry in America," by Fred M. Kimball, vice-president, Kansas Gas and Electric Co., Wichita. One-half day was devoted to a joint session with the Oklahoma Farm Electric Council. An engineering slide rule was awarded to Larry Kretchmar, outstanding agricultural engineering sophomore. New officers elected for the year 1960-61 were: W. T. Burtschi, chairman; D. A. Bly, vice-chairman; and C. E. Ferguson, secretary-treasurer.

### Central Illinois Section

The annual fall meeting of the Central Illinois Section was held at the Hotel Lincoln in Lincoln, Ill., on November 28. A cafeteria dinner at 6:45 p.m. was followed by the business meeting and program. There were 35 in attendance, including four students from India. Alexander Bartosik, a visiting professor from Poland and an ASAE member, told how Poland, like the United States, is having a big shift in population from agriculture to industry. The featured speaker was Melvin Gehlbach, fieldman with the Farm Bureau Farm Management Service, whose topic was "The Real Agricultural Problem Today. Is There a Solution?" The program also included the showing of the ASAE film "Agricultural Engineering — The Profession With a Future."

### Connecticut Valley Section

The Connecticut Valley Section will hold a meeting on January 25. The group will tour the Wiremold Co., West Hartford, at 1:30 p.m., after which a dinner-meeting will be held at Carville's Motor Court and Restaurant. The featured speaker, M. C. Ahrens, assistant chief of farm electrification research branch, AERD, ARS, USDA, will discuss "New Development in Research of the Farm Electrification Branch, AERD."

### Minnesota Section

The Minnesota Section will hold a meeting on January 26. The program will include an afternoon tour of the Minneapolis-Honeywell research facilities at Hopkins, Minn., which will be followed by a discussion of current projects at M-H. Elias Amdur will be the featured speaker at the 6:30 p.m. dinner at Buroch's Cafe. His topic will be "Humidity Sensors."

*(Continued on page 42)*

## Pacific Coast Chapter Holds Organizational Meeting


**The Northern Chapter (northern California and western Nevada) of the Pacific Coast Section held its organizational meeting in Berkeley, Calif., November 28. Approximately one-third of the 225 Chapter members attended this meeting, at which Leon V. Tichinin, one of the USA's agricultural representatives at the American National Exhibition in Moscow in 1959, gave an interesting talk. Shown above the Chapter officers attending the meeting pose with Pacific Coast Section officers:** ***(Left to right)*** **W. J. Adams, Section vice-chairman; Eugene Speck, Chapter chairman; William Pruitt, Chapter vice-chairman; Maurice Johnson, Jr., Section chairman; and Robert Curley, Section secretary-treasurer.** ***(Left)*** **Newly appointed Chapter officers are:** ***(Left to right)*** **William Pruitt, vice-chairman; Eugene Speck, chairman; Jack Williams, publicity and public relations chairman; and James Turner, arrangements chairman**

## MANUFACTURERS' LITERATURE

Literature listed below may be obtained by writing the manufacturer.

### Roller Pump Bulletins

*The Hart Equipment Co.,* P.O. Box 575, Rockton, Ill.—Two 2-page bulletins describe and illustrate Models 8R and 64C nylon roller pumps.

### Tractor Literature

*The Eimco Corp.,* 634 South Fourth West St., Salt Lake City 10, Utah — Literature describing and illustrating the 100 hp diesel 103 series tractor.

### Plow Catalog

*The Empire Plow Co.,* 3140 E. 65th St., Cleveland 27, Ohio — A 20-page, 2-color catalog, No. 56, describes and illustrates complete line of equipment.

### Spray Nozzle Catalog

*Delavan Manufacturing Co.,* Grand Ave. and Fourth St., West Des Moines, Iowa — A 16-page catalog, No. AG4, describes and illustrates spray nozzles and accessories.

### Filter Catalog

*Luber-Finer Inc.,* 2514 S. Grand Ave., Los Angeles 7, Calif.— Catalog contains a complete literature file of line of filters.

### Motor Selection Guide

*General Electric Co.,* Schenectady 5, New York. — No. GED-3909A 3 x 7-in. pocket-size card, provides quick reference to frame size (182 to 445U) and book price for a-c motors from ¾ to 125 hp. Data are tabulated for both dripproof and totally enclosed fan-cooled squirrel cage, horizontal motors.

### Clutch and Brake Material

*American Brake Shoe Co.* — Dept. A, 530 Fifth Avenue, New York 36, N. Y. — An 80-page catalog lists braking and other friction materials for power shovels, hoists, graders, take-off units, dozers, and farm tractors. Organic and sintered metallic materials are included for clutch and brake applications. Glossary of equipment technical terms and ordering information are included.

### Pneumatic and Hydraulic Controls

*The Rucker Co.,* 4720 San Pablo Ave., Oakland 8, Calif. — An 8-page illustrated catalog No. 601 contains descriptive detail of valves, cylinders, filters, lubricators, pumps, motors, accumulators, power units and other industrial and mobile components.

### V-Belt Bulletin

*Manhattan Rubber Division, Raybestos-Manhattan, Inc.,* Passaic, N. J. — An 8-page bulletin M-201 containing design features, ordering information, specifications, and graphically illustrated sections on the company's line of Condor V-belts and FHP V-belts. Also described are Condor double-V-belts for serpentine drives; CX fully molded V-belts, notched for use with small-sheave, high-speed drives; and poly-V drive which requires only 3 cross sections to fit all drives from 1/20 to 1700 hp.

### Bearing Data Sheets

*Miniature Precision Bearings, Inc.,* Keene, N. H. — A series of technical data sheets containing complete dimensional specifications and load factors for models R2, R3, and R4 instrument bearings made to ultraprecise ABEC class 7 tolerances.

### Booklet on Solid Lubricants

*Alpha-Molykote Corp.,* 65 Harvard Ave., Stamford, Conn. — A 24-page, 4-color booklet, Bulletin No. 124, describes the theory and practice of molybdenum disulfide as a solid lubricant and its performance under heavy loads and at high temperatures.

### Speed Reducer Brochure

*U. S. Electrical Motors, Inc.,* P. O. Box 2058 Terminal Annex, Los Angeles 54, Calif. — A 12-page brochure, No. F-2003, containing technical information on shaft-mounted geared speed reducers as well as illustrations, feature descriptions, and selection and ordering instructions.

### Deep Trough Belt Conveyors

*Link-Belt Co.,* Dept. PR, Prudential Plaza, Chicago 1, Ill. — A 12-page book No. 2716A contains capacity ratings and design information for 35-deg idlers and lists 12 types of 35-deg and six new types of 45-deg idlers for belt widths from 24 to 60 in. with steel, rubber cushion and positive action training rolls of equal and unequal lengths.

### Mechanical Shafts Seals

*Rotary Seal Division, Muskegon Piston Ring Co.,* Sparta, Mich. — An 8-page, 3-color folder describes and illustrates two designs in general purpose mechanical shaft seals — types KFA and KFB. Cutaway views of the seals are shown and also included is a list of minimum mounting dimensions, as well as a list of recommended seal materials for various mediums. Typical applications are given and a brief explanation of the sealing principle behind rotary seals.

### Flexible Couplings

*Diamond Chain Co.,* 402 Kentucky Ave., Indianapolis 7, Ind. — A 6-page brochure describes and illustrates high-capacity shaft-rated flexible couplings. Construction details on both finished bore and taper-lock bushed types are included, as well as complete specifications and prices.

### Controlled Environment

*Webber Manufacturing Co., Inc.,* P.O. Box 217, Indianapolis 6, Ind. — A 32-page brochure, No. 600, presents data on environmental testing and other applications for controlled atmospheric conditions. Included is a review of the nine main environmental applications and details on 13 types of environmental chambers and low temperature freezers, as well as data on temperature performance, specific heat of various substances, metal shrinkage, low temperature refrigerants, conversion fluids, temperature conversion, and temperature controls. Schematic diagrams are also given and a pictorial color chart summarizing data at altitudes from sea level up to two million feet is a special feature.

### Circular Roller Chain

*Acme Chain Corp.,* Holyoke, Mass. — A 4-page bulletin describes and illustrates roller chain designed to operate on curves. Illustrated is its most common use — a transfer medium from one straight line conveyor to another — as well as diagrams and installation photos of other uses. Also included are standard dimensions.

### Ball Bearing Units

*Sealmaster Bearing Division, Stephens-Adamson Mfg. Co.,* Aurora, Ill. — Catalog No. 454 presents complete line of ball bearing units and features technical and engineering data, specifications, diagrams, illustrations, and typical applications.

## . . . Winter Meeting

*(Continued from page 33)*

**ASAE officers helped the Georgia Section, ASAE's oldest state Section, in its second observance of its 25th Anniversary during the ASAE Winter Meeting in Memphis. See page 34 for details. At left are shown *(standing, left to right)* B. T. Virtue, president-elect; L. W. Hurlbut, president; S. M. Henderson, vice-president; J. L. Butt, executive secretary; *(seated, left to right)* R. H. Brown, Section chairman; and R. H. Driftmier, past-president of ASAE and first chairman of the Georgia Section. *(Above)* A special Silver Anniversary breakfast for Georgia Section was held during Winter Meeting, December 6.**

## . . . With ASAE Sections

*(Continued from page 40)*

### Section Gets New Name

The section formerly known as the Washton, D.C. Section is now officially the Washington, D.C. – Maryland Section, extending section affiliation to ASAE members throughout the state of Maryland. The first meeting for 1961 will be a luncheon meeting on January 13 in Room 6962, USDA South Building, Washington, D.C. The program will include a talk by Truman E. Hienton, chief, farm electrification research branch, AERD, ARS, USDA on farm electrification and uses in the British Isles.

### Southern California Chapter

The Southern California Chapter of the Pacific Coast Section will hold a dinner meeting on January 20 at Rodger Young Auditorium in Los Angeles. The featured speaker of the evening will be Glenn Williamson, who will present an illustrated talk on developments in feed handling and mixing for feed mills and feeding yards.

### Mississippi Section

The Mississippi Section held a luncheon meeting on December 20 at the Sedimentation Laboratory, Oxford. Included on the program was the showing of the ASAE film "Agricultural Engineering – The Profession With a Future." The balance of the program was built around the theme "What Agricultural Engineering Has to Offer" with discussions on new horizons for power and machinery in the 60's, electric power and processing, structures, and soil and water conservation. An inspection tour was made of the Sedimentation Laboratory following the meeting.

## EVENTS CALENDAR

January 30-February 3 — *American Society for Testing Materials Committee Week,* The Netherland Hilton Hotel, Cincinnati, Ohio. Write to ASTM, 1916 Race St., Philadelphia 3, Pa., for information.

February 3-4 — *Industrial Engineering Institute,* Schoenberg Hall, University of California, Los Angeles. For details write to: Department K, University of California Extension, Los Angeles 24, Calif.

February 5-11 — *National Electrical Week.*

February 9-11 — *Winter Meeting, National Society of Professional Engineers,* Hotel Fort Des Moines, Des Moines, Iowa. Contact NSPE headquarters, 2029 K St., N.W., Washington 6, D.C., for additional information.

February 12-16 — *National Rural Electric Cooperative Assn. Annual Meeting,* Dallas, Texas.

February 13-16—*American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Semiannual Meeting,* Conrad Hilton Hotel, Chicago, Ill. Information may be obtained from ASHRAE, 234 Fifth Ave., New York 1, N. Y.

February 22-23 — *Seminar on Automation and Numerical Control,* Bond Hotel, Hartford, Conn. Sponsored by the American Society of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.

February 23 — *Engineers, Scientists and Architects Day,* Presidential Arms Hotel, Washington, D.C., sponsored by D. C. Council of Engineering and Architectural Societies.

February 23-24 — *Annual Drainage Conference,* Hanford Hotel, Mason City, Iowa. Sponsored by Mason City Brick and Tile Co., 200 Brick and Tile Building, Mason City, Iowa.

February 28 - March 1 — *Ninth Annual National Dairy Engineering Conference,* Michigan State University, East Lansing, Mich. Contact Carl W. Hall, Agricultural Engineering Dept., MSU, East Lansing, Mich., for additional information.

**BULLETIN**

**As the Journal goes to press word has been received that Martin R. Huberty, director, Water Resources Center, University of California, Los Angeles, died on December 12, and James B. Kelley, retired professor of agricultural engineering, University of Kentucky and ASAE Life Fellow, died December 23. Further details will be carried in the February issue.**


**The following bulletins have been released recently. Copies may be obtained by writing to author or institution listed with each.**

The following publications are available from the Publishing House "Jugoslavija," Beograd, P.O. Box 62, Yugoslavia:

*Development of Agriculture in Yugoslavia.* N 1014-E. August 1960.

*Catalogue of Foreign Language Publications and Articles About Yugoslavia.* Rn 90/60-E.

*Break-Even Points for Harvesting Machines, by James C. Fortson.* Bulletin N.S. 66. December 1959. Georgia Agricultural Experiment Stations, University of Georgia, Athens.

The following plan sheets are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 5 cents each:

*Plan No. 7146.* Miscellaneous Publication No. 826. August 1960.

*Plan No. 7149.* Miscellaneous Publication No. 827.

*Plan No. 7157.* Miscellaneous Publication No. 830. October 1960.

*Plan No. 7158.* Miscellaneous Publication No. 828. August 1960.

*Horsepower Ratings of American Standard Roller Chains.* 1960. Association of Roller and Silent Chain Manufacturers, 3343 Central Ave., Indianapolis, Ind. Price, $1.00.

*The Road to Graduate School* — a description of what graduate study is like, what its goals are, and what it requires of the student. American Society for Engineering Education, University of Illinois, Urbana, Ill.

*Take a Fresh Look at Building with Masonry.* Reprinted from American Builder, August 1960. Structural Clay Products Institute, 1520 18th St., N. W., Washington 6, D. C.

*Measurements of Water Over Silted-In Weirs,* by G. L. Corey and Robert McFall. Bulletin No. 47. October 1960. Agricultural Experiment Station, Dept. of Agricultural Engineering, University of Idaho, Moscow, Idaho

*Tobacco Weight Losses During Curing,* by P. N. Winn, Jr., and O. E. Street. Bulletin A-111. June 1960. Agricultural Experiment Station, University of Maryland, College Park, Maryland.

*Standby Electric Power Equipment,* by Lowell E. Campbell. Bulletin No. 480. October 1960. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. Price 5 cents.

*Our Future Is Linked Together.* An interesting story of FEI and how it serves industry. Farm Equipment Institute, 608 S. Dearborn St., Chicago 5, Illinois. Price 25 cents.

*Guide to World Screw Thread Standards.* Over 2,000 standards covering 33 countries. W. H. A. Robertson and Co. Ltd., Small Part Division, Lynton Works, Bedford, England. Price $1.50.


**The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.**

**Anderson, Leonard H.** — Test engr., field eng. dept., Hawaiian Sugar Planters Assn., 1527 Keeaumoker St., Honolulu, Hawaii

**Ballou, David A.** — Pres., gen. mgr., Broward-Palm Beach Tractor Co., Inc., Box PP, Pompano Beach, Fla.

**Basu, Manishi** — Teaching and res., Government of India. (Mail) P. 560, Lake Rd., Calcutta 29, India

**Bennett, Allyn C.**—Field spec., eng., (SCS) USDA. (Mail) 2 E. Walker St., Temple, Tex.

**Bennett, Thomas O.** — Supervisor field testing, F. E. div., and supervisor field test at Phoenix Ariz. for farm equip. div., International Harvester Co. (Mail) 6618 N. 7th Dr., Phoenix, Ariz.

**Bouyoucos, George J.** — Res. prof. (emeritus), Michigan State University. (Mail) Box 773, East Lansing, Mich.

**Brown, Ralph W.** — Agr. engr., res., USDA, Market Serv., University of Georgia. (Mail) 220 Pine Needle Rd., Athens, Ga.

**Bubenzer, Tillman** — Gen. mgr. and consultant, Conner Prairie Farms. (Mail) R.R. 4, Noblesville, Ind.

**Button, Louis S., Jr.** — Agr. engr., (SCS) USDA. (Mail) Jeffersonton, Va.

**Cotton, Thomas H.** — Irrigation and drainage engr., International Engineering Co. (Mail) P.O. Box "R", Port-au-Prince, Haiti

**Dankel, Douglas D.** — Chief engr., Minneapolis Moline Co. (Mail) 3912 Natchez Ave., St. Louis Park 16, Minn.

**De Blieck, Fred B.** — Asst. chief product dev. engr., eng. test and dev. dept., International Harvester Co., 11 Ave. and 3rd St., East Moline, Ill.

**Domier, Kenneth W.** — Asst. prof., agr. eng. dept., University of Manitoba, Winnipeg, Man., Canada

**Dunn, Milton D.** — Farm operator, Box 57, Duncan, Miss.

**Ferguson, James M.** — Farm operator, P.O. Box 43, Calhoun City, Miss.

**Fox, William R.** — Instr., agr. eng. dept., Iowa State University, Ames, Iowa

**George, Edwin O.** — Vice pres. of sales, The Detroit Edison Co., 2000 2nd Ave., Detroit 26, Mich.

**Glenn, Richard L.** — Working in des. of materials handling and grain storage structures, Butler Mfg. Co. (Mail) 4825 W. 78th St., Prairie Village 15, Kans.

**Hart, Jimmie A.**—Eng. aid, SWCRD (ARS), USDA, Watershed Technology Res. Br., Watershed Runoff Investigations. (Mail) P.O. Box 112, Holly Springs, Miss.

**Hopson, James H.** — Construction management engr., (SCS) USDA. (Mail) P.O. Box 1898, Fort Worth, Tex.

**Janosi, Zoltan** — Automotive res. engr., Land Locomotion Lab., R & E Div. (Mail) 28012 Palomino, Warren, Mich.

**Junge, Hand R.** — Civil engr., The Danish National Inst. of Bldg. Res., 20 Borgergade, Copenhagen, K., Denmark

**Ladd, Thomas B.** — Asst. agr. engr., Georgia Exp. Sta., Experiment, Ga.

**Mann, George S.** — Mgr., Federal Land Bank Association. (Mail) 1225 Blair Ave., South Pasadena, Calif.

**Montie, Valsin J.** — Branch mgr., John Deere Co. (Mail) P.O. Box 47, Memphis, Tenn.

**Moore, Vernon P.**—In charge of Cotton Ginning Res. Lab., AERD (ARS), USDA, Box 426, Leland, Miss.

**Nylander, Paul E.** — State conserv. engr., (SCS) USDA. (Mail) 6227 Jerome Blvd., Harrisburg, Pa.

**Parr, Harry E.** — Product dev. engr., The Ohio Rubber Co., Ben Hur Ave., Willoughby, Ohio

**Pursley, Samuel C.** — Farm and dairy supervisor and supervisor of campus and greenhouse, Georgia Training School, Gracewood, Ga.

**Redman, Stephen** — Agr. engr., Government of Trinidad and Tobaco. (Mail) Central Exp. Sta., Arima P.O., Trinidad, British West Indies

**Rieckers, Howard C.** — Eng. aid for agr. engrs., (SCS) USDA, 300 Main St., Dayton, Wash.

**Runov, Boris A.** — The Chair of Using Electricity in Agr., Timiryazer Agr. Academy, Moscow, USSR. (Mail) Agr. Eng. Dept., Iowa State University, Ames, Iowa

**Simrall, Harry C. F.** — Dean, School of Engineering, Mississippi State University. (Mail) P.O. Box 217, State College, Miss.

**Sison, Alejandro S.** — Supervising proj. engr., Bicol Peninsula Irrigation Dist., Bur. of Public Works, Naga City, Philippines

**Smith, Jesse M.** — Claims adjuster, M. F. A. Insurance Co. (Mail) 935 Owens St., Jonesboro, Ark.

**Soteropulos, Gust** — Sr. des. engr., John Deere Ottumwa Wks., Ottumwa, Iowa

**Stilwell, Robert E.** — Chief dev. engr., John Bean Div., Food Machinery and Chemical Corp., P.O. Box 145, San Jose, Calif.

**Summers, Allen W.**—(With U.S. Air Force). (Mail) 2227 Leafmore Dr., Decatur, Ga.

**Summers, Harlan N.** — Sales engr., des. eng., King City Concrete Pipe and Irrigation. (Mail) 3117 Hollins St., Bakersfield, Calif.

**Tineo, Israel** — M. A. C., Venezuelan Government. (Mail) Agr. Eng. Dept., Colorado State University, Fort Collins, Colo.

**Traphagen, Friedrich** — Scientific asst. of the board of the pres. of the FAL Braunschweig-Voeckenrode, Forschungsanstalt fuer Landwirtschaft, Braunschweig-Voelkenrode, Bundesallee 50, Braunschweig, Germany

**Turkett, Warren B.** — Training officer, (SCS) USDA. (Mail) Box 1481, Athens, Ga.

**Walker, Marion W.** — Farm owner and operator, R.R. 1, Greenville, Miss.

**Wasson, Billie E.** — Hydraulic engr., Ground Water Branch, U.S. Geological Survey. (Mail) 409 N. Natchez St., Kosciusko, Miss.

**Worley, Hubert F.** — State engr., Farmers Home Adm. (Mail) 1525 4th Ave., Jackson, Miss.

### TRANSFER OF MEMBERSHIP

**Boyd, Morton M.** — Asst. chief engr., United Co-op, Inc., 111 Glamorgan St., Alliance, Ohio (Associate Member to Member)

**Clark, John H.** — Instr. and ext. spec. in agr. eng., Kemptville Agr. School. (Mail) Mountain, Ontario, Canada (Affiliate to Member)

**DeKramer, Ray H.** — Chief, irrigation practices and operation branch, Bureau of Reclamation. (Mail) 1441 McDonald Dr., Huron, S. D. (Associate Member to Member)

**Donoghue, Lawrence A.**—Instr. and ext. spec., ext. engr. in farm structures, Kemptville Agr. School, Ontario Dept. of Agr., Kemptville, Ontario, Canada (Affiliate to Member)

**Fox, Sherman D.** — Asst. plantation engr., Dale Corp. (Mail) 91-939 Komana St., Ewa, Oahu, Hawaii (Associate Member to Member)

**Furry, Ronald B.**—Asst. prof., ext. agr. engr., agr. eng. dept., Riley-Robb Hall, Cornell Univ., Ithaca, N. Y. (Associate Member to Member)

**Keppel, Robert V.** — Proj. supervisor, hydrologic res., (ARS) USDA, Box 4096, Tucson, Ariz. (Associate Member to Member)

**Lauritzen, Cyril W.** — Soil scientist, (ARS), SWC, USDA, Eng. Bldg., 101, Utah State Univ., Logan, Utah (Affiliate to Member)

**Manges, Harry L.** — Irrigation res. engr., Kansas State Univ. (Mail) 2109 G St., Belleville, Kans. (Associate Member to Member)

**Marmorine, Marvin O.** — Agr. eng. mgr., Green Giant Co. (Mail) 1362 N. Court St., Le Sueur, Minn. (Associate Member to Member)

**Morr, Ralph V.** — Product engr., New Idea Div., AVCO Corp. (Mail) 616 N. Cherry St., Celina, Ohio (Associate Member to Member)

**Pedersen, John H.** — Mgr. in charge of des., Midwest Plan Service. (Mail) Agr. Eng. Bldg., Iowa State Univ., Ames, Iowa (Associate Member to Member)

**Richter, Donald W.** — Sr. sales engr., Armco Drainage & Metal Products, Inc., 703 Curtis St., Middletown, Ohio (Affiliate to Member)

**Speck, Eugene P.** — Asst. head of field stations and spec. in agr. eng., Univ. of California. (Mail) 903 Oak Ave., Davis, Calif. (Associate Member to Member)

**Summers, Neil W.** — Sr. des. engr., John Deere Ottumwa Wks., Ottumwa, Iowa (Associate Member to Member)

### STUDENT MEMBER TRANSFERS

**Carlson, George H.** — (University of Minnesota) 2518 Polk St., N.E., Minneapolis, Minn.

**Coonrod, Donald H.** — (Texas Technological College) 3110 Buffalo Gap Rd., Abilene, Tex.

**Johnson, Carl R. E.** — (University of Saskatchewan) Box 248, Canwood, Sask., Canada

**Olmstead, Lee E.** — (Iowa State University) Conrad, Iowa

**Rausch, David L.** — (Ohio State University) 38 E. 12th Ave., Columbus, Ohio

**Smith, Wayne L.** — (University of Tennessee Graduate School) 3693 Johnwood Dr., Memphis, Tenn.

## PERSONNEL SERVICE BULLETIN

Note: In this bulletin the following listings current and previously reported are not repeated in detail. For further information, see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this bulletin, request form for Personnel Service listing.

**Positions Open – July** – O-245-623, 256-624. **August**–O-270-625. **September**–O-271-626, 303-627, 303-628, 303-629, 303-630, 273-631, 284-632, 309-634. **October**–O-318-636, 320-637, 322-638, 322-639, 322-640, 325-642, 326-643, 341-644, 347-645. **November**–O-372-646, 392-647, 393-648. **December**–O-407-649, 427-650, 425-651, 429-652, 388-653.

**Positions Wanted–July**–W-221-53, 252-57, 253-58, 257-60. **August**–W-263-61, 264-62. **September**–W-274-65, 281-66, 282-67, 283-68, 294-70, 287-73, 297-74, 300-75. **October**–W-305-76, 314-77, 323-78, 328-79. **November**–W-338-80, 377-81, 379-83, 365-84, 376-86, 355-87, 394-88. **December**–W-420-89, 419-90, 415-91, 412-93.

### NEW POSITIONS OPEN

**Sales Manager (national)** to develop and promote new patented plastic greenhouse. Headquarters in Cleveland, Ohio or Chicago, Ill. Extensive travel. Thorough knowledge of commercial growing, preferably both in vegetable and flower field. The man hired will be in charge of a new product line for an established manufacturer, and could advance in proportion to his success in promoting the product. Salary $8,000 or higher depending on experience. O-434-654

**Agricultural Engineer** for product design and development of equipment for harvesting vegetable crops for canning plants. Wisconsin location. BSAE or BSME with some design experience. Good opportunity for advancement. Salary open. O-440-655

**Agricultural Engineer** for creative production design work on tractor-mounted and self-powered farm machinery. Full range from initial concept through production specifications. Established manufacturer. Southern location. Age 25-30. BSAE or BSME. Experience 3-5 years in farm implement design. Able to work as member of a development team. Excellent opportunity in expanding company with challenging development program. Salary open. O-461-656

**Product Design Engineer** with experience in the design of planting and/or cultivating machinery. Board work experience necessary. Excellent potential for aggressive engineer with ideas. Large full-line company with world wide operations. Will pay relocation expense. Salary commensurate with experience. BSAE or ME. Age 25-35. O-465-657

**Research and Development Engineer** for advanced design engineering work on harvesting machinery and tractor development projects. MSAE with major and proficiency in basic engineering and design field. Minimum 5 years design experience. This position is for a creative engineer interested in agricultural machinery development. Excellent opportunities for advancement. Work wide product application. Position available immediately. Relocation expenses paid. Salary open. Excellent fringe benefits and vacation plan. Age 25-40. O-465-658.

### NEW POSITIONS WANTED

**Agricultural Engineer** for extension, teaching or research in power and machinery or product processing with college or experiment station, preferably in a western state. Some travel. Married. Age 39. Minor disability, service connected. BSAE, 1943, A & M College of Texas. MSAE, 1951, University of California. Farm background. War commissioned service in Army Corps of Engineers. Teaching and research experience in power and machinery 8 years, University of Arizona. Research project leader in farm mechanization, University of Idaho, 1¾ years. Research project leader on mechanizing cotton production and harvesting in the high plains area, USDA. Registered professional engineer. Available June 1961. Salary $9,500. W-431-94

**Agricultural Engineer** for design, development or research in power and machinery with manufacturer in Midwest or East. Willing to travel. Married. Age 28. No disability. BSAE, December 1960, Michigan State University. Farm background. One summer in engineering department of major manufacturer. One summer part time work in college agricultural engineering department. Enlisted service in Army 2 years. Available January 20. Salary open. W-444-95

**Irrigation Specialist** for design, development, or research in soil and water field with public service agency, anywhere in USA. Single. Age 28. No disability. BS in agriculture, College of Agriculture, Iran, 1954. Graduate study in irrigation, Utah State University, 1957-58. Experience in charge of irrigation research, Agricultural Engineering Department of Iran. Available on one month notice. Salary $200-$300 per month. W-453-96

**Agricultural Engineer** for teaching and research in power and machinery with college or experiment station in eastern USA. Married. Age 29. No disability. BSAE, 1959, Pennsylvania State University. MSAE expected June 1961, Ohio State University. Four years in farm partnership prior to military service. Two years enlisted service in Army, 1953-55. One year machine design with full-line manufacturer. Research assistant while working on MS degree. Available June 1961. Salary open. W-468-97

### SPECIAL NOTICE

Forty Cuban agricultural engineers in exile in the United States are available for employment consistent with their training, experience, and status. They have organized as the Cuban National Association of Agricultural Engineers in Exile.

This circumstance has been reported to ASAE by two of the group who are ASAE members.

Professionally, their services might be useful in any area of tropical or semitropical agriculture similar to that of Cuba, or to manufacturers of products especially engineered for agriculture in these areas.

For further information as to qualifications and conditions under which they are available for employment, write direct to Cuban National Association of Agricultural Engineers in Exile, P.O. Box 1495, Miami 1, Fla.

This notice is published in the interest of professional service to the individuals concerned and employers who might profitably utilize their abilities.

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## Consulting Agricultural Engineers

MEMBERS of ASAE who are employed as consulting agricultural engineers or wish to be listed as such in the "Consulting Agricultural Engineers" section of the 1961 AGRICULTURAL ENGINEERS YEARBOOK (See pages 393 to 395, 1960 edition) are urged to supply the necessary information by February 1, 1961.

All that is required to be listed is to furnish: complete name and address, a brief description of consulting services (not to exceed 50 words), specify whether registered professional engineer, and list specialty by division interest; such as, Power and Machinery, Farm Structures, Electric Power and Processing, and Soil and Water. Those whose services extend beyond one division may be listed accordingly. Send the above information to the attention of J. Basselman, Editor, AGRICULTURAL ENGINEERS YEARBOOK, 420 Main St., St. Joseph, Mich.

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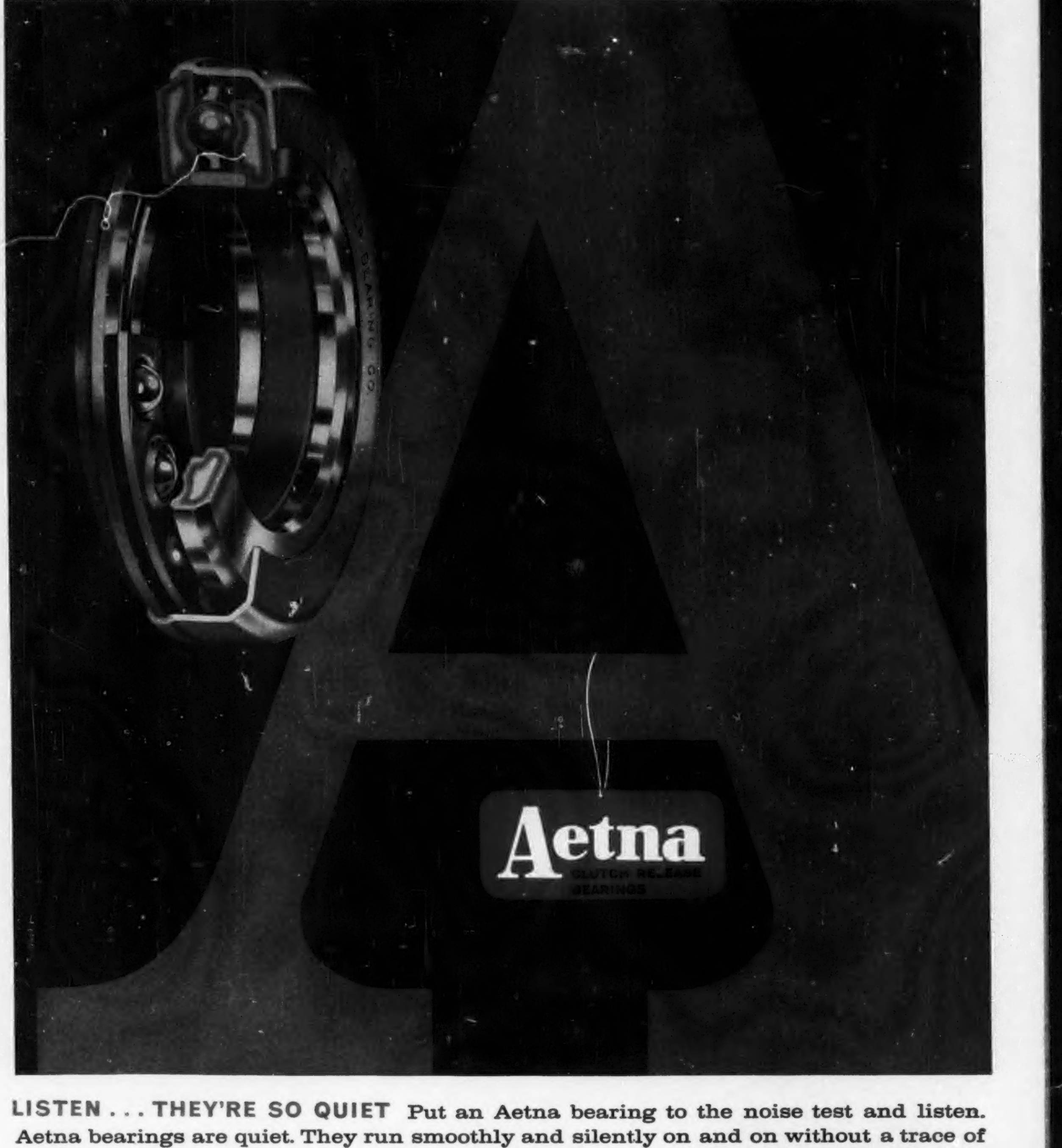


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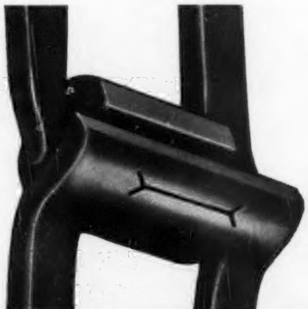

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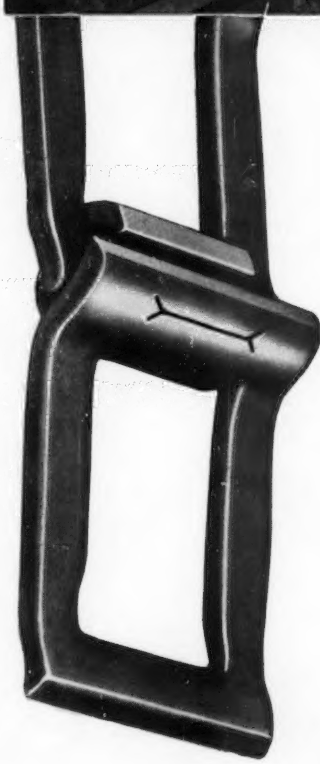

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